STUDIES IN THE XYLARIACEAE: III.

SOUTH AFRICAN AND FOREIGN SPECIES OF *HYPOXYLON* SECT. ENTOLEUCA†

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Introduction

The South African species of *Rosellinia* and *Hypoxylon* have received scant treatment, the only authoritative work being that of Miller (1942) based on the collection at the National Herbarium, Pretoria. For the past eight years the writer has had opportunity to examine material from this country and from overseas, and to study in detail representative members within various species groups. This paper concerns the non-coloured species of *Hypoxylon*, many of which were formerly placed in *Rosellinia*.

Methods and Materials

I. *General Investigation.*

Both herbarium material and collected specimens were routinely investigated. Collected material that was still viable was also crushed in sterile distilled water on a slide, and the ascospores extracted while viewing the preparation microscopically, by means of a micropipette. Spores were sown onto the surface of 2% malt agar plates with streptomycin. By viewing the agar surface through the reverse of the plate under the microscope it was possible to keep track of germinating spores and to distinguish them from contaminants. Pure cultures were eventually obtained. Descriptions of the cultures were made chiefly using plate and bottle cultures. Two per cent malt agar was used as the chief medium because preliminary experiments showed that the fungi grew on this with greater

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†Accepted for publication. 21st March, 1967.

luxuriance than on other media and showed differences from each other that could be expressed in precise terms. At least 15 and usually 20—25 plate cultures of each strain were examined in order to make a description of the external characters. These cultures were incubated at 5 temperatures, 15°, 20°, 25°, 28° and 31°C, and observations were made 3—10 days after, depending on the rate of growth of the colony. Duplicate and often triplicate cultures were also prepared using three other media, Leonian's, Czapek—Dox agar and maize agar, prepared according to formulae cited by McLean and Cooke (1941) and Wehmeyer (1924).

Each strain was also cultured in 8-oz medicine bottles of all four media. Malt cultures were given greater emphasis in that several replicates were prepared. The bottle cultures were incubated at 25° for 14 days, after which they were systematically investigated, although observations were actually made after the first 7 days and continued for many months thereafter. Except where specifically mentioned all descriptions of the bottle cultures were based on their appearance when 14 days old.

In the species descriptions the behaviour of malt agar was taken as standard, and reference to other media made only in specific instances since the general characters on all media were found to be the same, and the chief differences between them mainly comprised degree of luxuriance only.

II. *Terms used to express the growth characters of the mycelium.*

The following terminology was adopted from Long and Harsch (1918) and new terms have been added to express those growth characters not already described:

A. *General Growth Character*

1. *Submersed:* Colony growing entirely below the surface of the agar; aerial mycelium none.
2. *Canescent/ Downy:* Aerial mycelium consisting of short fine hyphae, loosely scattered over the surface of the agar. In most of these colonies the majority of the growing hyphae are still below the agar surface, however.
3. *Felty:* Aerial mycelium matted, with intertwined hyphae resembling a thin felt; surface coarse or smooth.
4. *Cobwebby:* Aerial mycelium intermediate between felty and canescent; usually characterized by long weak intertwined hyphae lying in all directions.
5. *Silky:* Similar to the above, but the hyphae lie parallel, giving the appearance of combed silk.

6. *Cottony:* Aerial mycelium comprising a loose mass of erect rather long hyphae (3—5 mm.).
7. *Velvety:* Aerial mycelium dense and usually rather compact in contrast to the above types; surface smooth resembling the "pile" of velvet due to many short, straight closely growing hyphae. The velvety appearance is usually enhanced by zonate growth.
8. *Fleecy:* Aerial mycelium very dense though not necessarily very thick, opaque with the characteristic uneven surface similar to that of a fleece.
9. *Lanose/ Woolly:* Aerial mycelium forming a dense opaque mass, usually with a smooth surface; normally very thick (3—5 mms.), and consisting of long tortuous hyphae.
10. *Floccose:* The aerial mycelium may be initially appressed velvety or fleecy, but is distinct in that scattered pulvinate or irregular patches of short mycelium arise all over the surface of the colony as it grows older.

B. *Aspect.*

1. *Gelatinous:* The surface of the colony is smooth and to some extent shiny, resembling gelatine. A gelatinous surface is characteristic of some but not all submersed or canescent colonies.
2. *Sodden:* The mycelium has a water-soaked appearance. The colony varies from appressed to velvety but is never fleecy or lanose.
3. *Dry:* The opposite of that just described. It is characteristic of the great majority of the species investigated.
4. *Appressed:* The aerial mycelium is very compact and tends to grow more or less parallel with the agar surface. This aspect is typical of canescent and velvety colonies.
5. *Plumose:* Dry, with tufts of mycelium, particularly near the margin, that have a central core from which short hyphae radiate.
6. *Zonate:* The aerial mycelium differs in character within the same colony, forming concentric zones of different degrees of luxuriance. Typical of velvety colonies.

III. *Terms used to express the type of germination.*

When germinating spores were being observed through the reverse of the agar plate on the compound microscope, a minor point of difference between species was observed in the manner of growth of the hyphae (Fig. II). In some species germ tubes appeared at irregular intervals through the germ slit and the branches from these radiated symmetrically, while in others the germ tubes arose more or less from the opposite apices of the spore and the branches proceeded irregularly. The first type is termed radiate and the second free-spreading.

IV. *The Problem of Spore Dimensions.*

Up to the present, most descriptions of species in the *Xylariaceae* given in Saccardo's Sylloge Fungorum and elsewhere, simply record a range of spore dimensions, rarely accompanied by an average measurement to the nearest micron. This lack of precision was the main stumbling block in identification of material for the present work. When the observed range of dimensions exceeded or overlapped the one recorded it was impossible to know whether the identification was correct or not. Confirmation by overseas authorities only partly solved the problem.

In recording spore dimensions for this work therefore, two items were therefore clearly determined:

A. the range of width and length to the nearest $0\cdot5\mu$.

B. The average value of width and length to the nearest $0\cdot1\mu$.

These were based on measurements of at least 10 spores per strain to the nearest $0\cdot75\mu$ or less.

V. *Abbreviations.*

The following abbreviations have been used for herbaria in this and succeeding papers:—

AA.:	University of Michigan Herbarium, Ann Arbor, Mich., U.S.A.
CMI:	Commonwealth Mycological Institute, Kew, Surrey, England.
FBLA:	Forest Biology Laboratory, Calgary, Alberta, Canada.
FBLBC:	Forest Biology Laboratory, Victoria, B.C., Canada.
FBLNB:	Forest Biology Laboratory, Fredericton, N.B., Canada.
Mill:	Miller Herbarium, Georgia Experiment Station, Experiment, Ga., U.S.A.
NFC:	National Fungus Collection, Beltsville, Md., U.S.A.
NYBG:	New York Botanical Garden, New York, U.S.A.
Pret.:	National Herbarium, Pretoria, South Africa.
R.:	Rijks Herbarium, Leiden, Holland.

ANALYSIS OF SPECIES

South African Species.

1. **Hypoxylon corticium** (Schw.) Martin comb. nov.

sub *Rosellinia corticium* (Schw.) Sacc. Ellis, J. B. & B. M. Everhart North Amer.

Pyren. 164, (1892), Saccardo, P. A. Sylloge Fungorum **I**, 253, (1882), Shear, C. L. Mycologia **33**, 327, (1941).

sub *Rosellinia megaloecia* E. & E. Ellis, J. B. & B. M. Everhart Proc. Acad. Nat. Sci. Philad. III, **23**, 128, (1893).

sub *Sphaeria corticia* (Schw.) Schweinitz, L. v.d. Schr. d. Naturf. Ges. Zu. Leipzig **1**, 44, (1822).

Stromata globose to pulvinate, brownish-black, forming small glomerules 1·2—2·2 × 1·2—3·2 × 1·2—3·0μ, normally closely aggregated and embedded in dark matted subiculum of closely anastomosed reticulate or pseudoparenchymatous hyphae, but occasionally gregarious and lacking a subiculum (Plate I: 7). Outer ectostroma dull murky brown, merging with the carbonous layer of the entostroma; basal tissue soft, dark brown and usually fairly limited in extent. Perithecia 1—3 per stroma, globose, relatively large, occupying most of the interior of the stroma at maturity and also normally clearly evident externally, 800—2,100 × 800—1,500μ; ostioles papillate and usually prominent. Asci cylindric, short stipitate; ascal plugs constricted. Spores elongate—elliptic or navicular, inequilateral, dark brown to black; germ slits on the convex side. The perfect stage mainly differs from that of *H. aquilum* in the absence of spore apiculae.

There are two apparent varieties:—

a) var *macrosporum* Martin, nov. var.
Asci 230—275 × 11—12μ, stipes 48—63μ.
Spores 9·5—13·5 × 21·5—39·0μ, ave. 9·9 × 26·5μ.

b) var *microsporum* Martin, nov. var.
syn. *Rosellinia megaloecia* E. & E.
Asci 170—200 × 6—10μ, stipes 37—50μ.
Spores 5·5—9·5 × 12·5—25·5μ, ave. 7·5 × 19·4μ.

South African Hosts: Royena lucida, Kiggelaria africana, Olea capensis, Maytenus buxifolia.

Material examined:

sub *Rosellinia aquila.* A large quantity of material in the 'Rijks Herbarium. ex Cornell expedition det. Seaver; Labrador Lake, Ithaca, NY, U.S.A. (1919), (NYBG). Burke 9; Montgomery Co., Alabama, U.S.A. (1916), (NYBG).

sub *Hypoxylon corticium.* Martin 16, 22, 77, 316, 565, 1,029, 1,035; Nature's Valley, Knysna Dist., W. Cape, South Africa (1958, 1959, 1962). Martin 540, 544; Hogsback near Alice, Eastern Cape, South Africa, (1959). Martin 565; Highlands, Albany District, Eastern Cape, South Africa, (1959). Martin 588, 611; Los Angeles, S. Calif., U.S.A., (1961). Martin 949; Mazat-

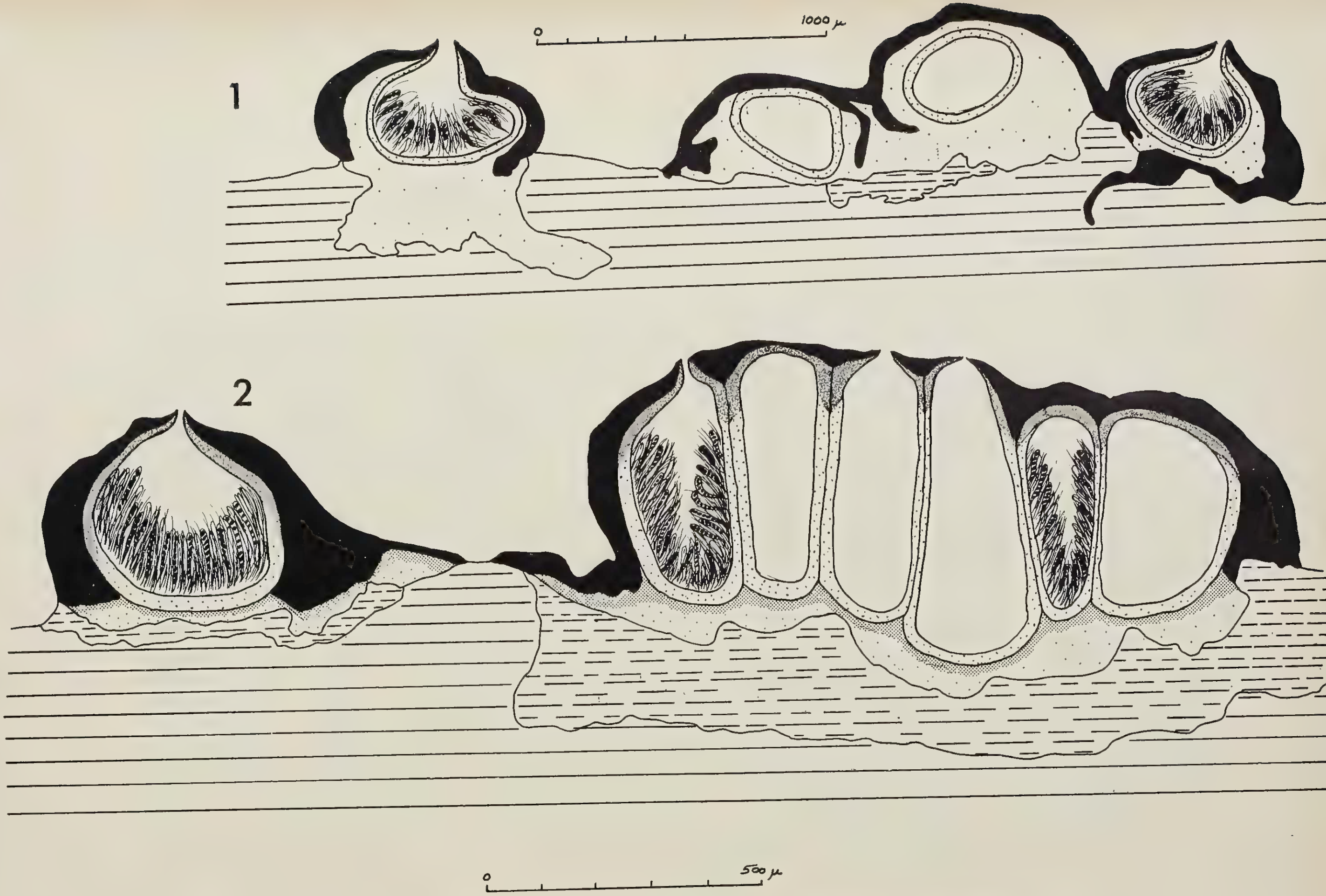


Fig. I. Diagrammatic drawings of longitudinal sections through the stromata of:
1. *Hypoxylon discolor.* 2. *Hypoxylon smilacicolum.*
Solid black : carbonous entostroma

làn, Sinaloa, Mexico, (1961). Martin 1179; Lake Ozark, Missouri, U.S.A., (1962). Martin 1625, 1627; Nyack Village, Rockland Co., NY State, U.S.A., (1963.)

Cultural Characters (Plate III: 3):

Germinating pattern free spreading. A rather thin dull white to greenish felt with a silky appearance is formed, later becoming somewhat cobwebby with loose mycelium up to 12 mm. high; with age the colonies sometimes become depressed in the centre while the marginal region remains luxuriant. Margin not distinct, felty, appressed, effuse, entire with widely dispersed peripheral hyphae. Stain absent; carbonization usually absent, but seen on Czapek bottle cultures after about 2 months old. Czapek cultures are less luxuriant than on malt. Growth on malt at 25°C is 4·80—7·90 mm./day.

Microscopic Characters:—

The primary mycelium is much broader than in previous species, the marginal hyphae having a maximum width of 3·1μ (Fig. II: 5). Also there is a well developed secondary mycelium, composed of 2 main types of branching system, one composed of long filaments which branch repeatedly at right angles and interclasp and anastomose to form a felt of indefinite extent (Fig. II: 10) and another lying beneath the first which comprises stouter bulbous hyphae not so closely associated (Fig. II: 6). The first type of mycelium has a diameter of 2·3—2·9μ, while the bulbous type is 5·4—16·6μ in diameter.

The reticulate secondary mycelium and conidiophores produced in culture correspond exactly in organisation to the subiculum and conidiophores associated with the perfect stage. Mycelium resembling the subiculum of collected specimens was also produced by infecting twigs with primary mycelium of *H. corticum* and leaving them in the open near a stream in a shady kloof. After 3 months pulvinate masses of dark subicular mycelium were found along the bark of the twigs. The surface of the mycelium was covered with conidiophores agreeing with those found in association with the perfect stage of many collected specimens (Fig. II: 10). Conidiophores were not produced in culture *in vitro* by all strains.

The conidiophores often in contrast to the dark mycelium bearing them, are light coloured, and hyaline. They are determinate in growth but variable in length and each consists of a long stalk 100—1,080 × 2·3—4·5μ, and a terminal multibranched portion giving rise to many fertile branches. These are usually fairly short, 15—52 × 2·3—4·5μ with a fertile region 6—10μ, and are unseptate. The conidia are acropleurogenous, densely clustered, and form spicate or almost capitate heads. They are sessile on geniculate projections, apparently without definite order; in size they are relatively large and oval elliptic with truncate bases or sometimes pyriform, subhyaline, and very pale grey or greenish grey collectively, 2·3—3·7×4·5—10·0μ, av. 3·1×6·8μ.

2. **Hypoxylon aridicolum** Martin nov. sp.

It was impossible to find more than a small sample of this species so that the following description cannot be taken for a generalised account. It is clearly similar to *H. corticium* in possession of a subiculum and in general stromal characters. The perithecia are large globose, 1,500—200×1,200—1,700μ. The difference between the two species lies in the spores which are elliptic with acutely pointed ends, inequilateral, usually light brown and measuring 4·5—9·0 ×14·0—24·0μ, ave. 6·8×18·7μ. The asci are cylindrical with fairly long stipes, 140—150×9μ; stipes 30—60μ.

Material examined:

Martin 508; on *Schotia latifolia*, Fish River Valley near Grahamstown, Eastern Cape, South Africa, (1959).

Cultural Characters:

Germination pattern free spreading. In colony characteristics this species resembles the preceding so closely in general features that no separate description seems necessary. Both bottle and plate cultures and the microscopic characters are identical in form and dimensions, but the following features are peculiar to *H. aridicolum*:—

1. There is no difference in growth of cultures on Czapek and on malt, whereas in *H. corticium* Czapek cultures are much less luxuriant.
2. No conidiophores have been developed in culture.
3. The growth rate on malt differs significantly from that of *H. corticium*, this species growing faster at all temperatures, and also having a higher temperature tolerance. Growth at 25°C is 9·74 mm./day.

3. **Hypoxylon perusensis** (P. Henn.) Martin comb. nov.

sub *Rosellinia perusensis* P. Henn. Hennings, P. Hedwigia **48**, 10, (1908), Saccardo, P. A. Sylloge Fungorum **XXIV**, 837, (1926).

Stromata small, glomerular or pulvinate, 0·5—5×0·5—20×0·6—1·5 mm., often deep black and shiny, uniperitheciate, globose or with several perithecia under a superficial covering that closely follows their outline, pulvinate when the perithecia are closely associated (Plate I: 6). Ectostroma rudimentary, entostroma mostly carbonous, with soft basal tissue slight in quantity. Perithecia 450—900×650—1,400μ; ostioles indistinct, papillate. Asci narrowly cylindric, 85—140×6μ, with stipes 20—60μ. Spores oval with rounded ends, pale brownish grey, subhyaline, 3·0—6·0×6·0—11·0μ, ave. 4·9 x 9·3μ.

Material examined: Martin 45, 76, 440; on *Passerina falcifolia*, Nature's Valley, Knysna District, Western Cape, South Africa, (1958, 1959). Martin 256; wood unidentified, Alexandria Forest, E. Cape, South Africa, (1958). Martin 430; on *Maytenus buxifolia*, Nature's Valley, Knysna District, Western Cape, South Africa, (1959). Merrill; Flora Philippines 8,768 det. Sydow, Taytay, Palawan, Philippines, (1913), (NYBG).

Cultural Characters (Plate III: 1).

Germination pattern radiate. Colonies canescent, white subhyaline, with a moderately coarse surface. In old colonies in bottle culture and sometimes on plates very small superficial aggregates of mycelium lend the colony a characteristic granulate appearance. Margin submersed, hyaline and colourless, in some cases entire, in others lobed or segmented, peripheral hyphae dispersed. Stain and carbonization none. Growth at 25°C slow, 1·95 mm./day.

Microscopic Characters:

Primary mycelium with no distinguishing character, marginal hyphae with a maximum diameter of 2·0μ; secondary mycelium nil.

4. *Hypoxylon ravenelii* Rehm.

Ellis, J. B. & B. M. Everhart, Jour. Mycol. **4**, 111, (1887), Ellis, J. B. and B. M. Everhart, North Amer. Pyren., 655, (1892), Rehm, H. Hedwigia **21**, 136, (1882).

Stromata uniperitheciate and globose or multiperitheciate and pulvinate, but rarely with more than 6 perithecia per stroma, 0·6—1·9×0·6—4·8× 0·6—1·3 mm., shiny black, often with a circular indentation in the surface near the vertex of each perithecial outline (Plate I:3). The perithecia are globose, 400—900×600—1,100μ. Asci cylindric with short to moderately long stipes, 105—115×6μ, stipes 25—50μ. Spores oval, equilateral with rounded ends, pale amber yellow, 4·0—7·0×8·0—13·0μ ave. 4·8×10·3μ.

This species is close to *H. chrysoconium* B. & Br. in stromal form.

South African hosts include: *Canthium spinosum*, *Cassine croseum*, *Tarchonanthus camphoratus.*

Wood and bark are usually densely infested. Often the pearly white initial stage is innate in the substrate as in members of *Anthostomella*, and the stroma becomes superficial only towards maturity, due to attrition.

Material examined: Chrisfield in Miller Herb. 3397, Savannah, Ga. U.S.A., (1929), (Mill.) Martin 332, 367, 369, 428, 434, 435, 438, 439, 461, 506; Nature's Valley, Knysna District, Western Cape, South Africa, (1958, 1959).

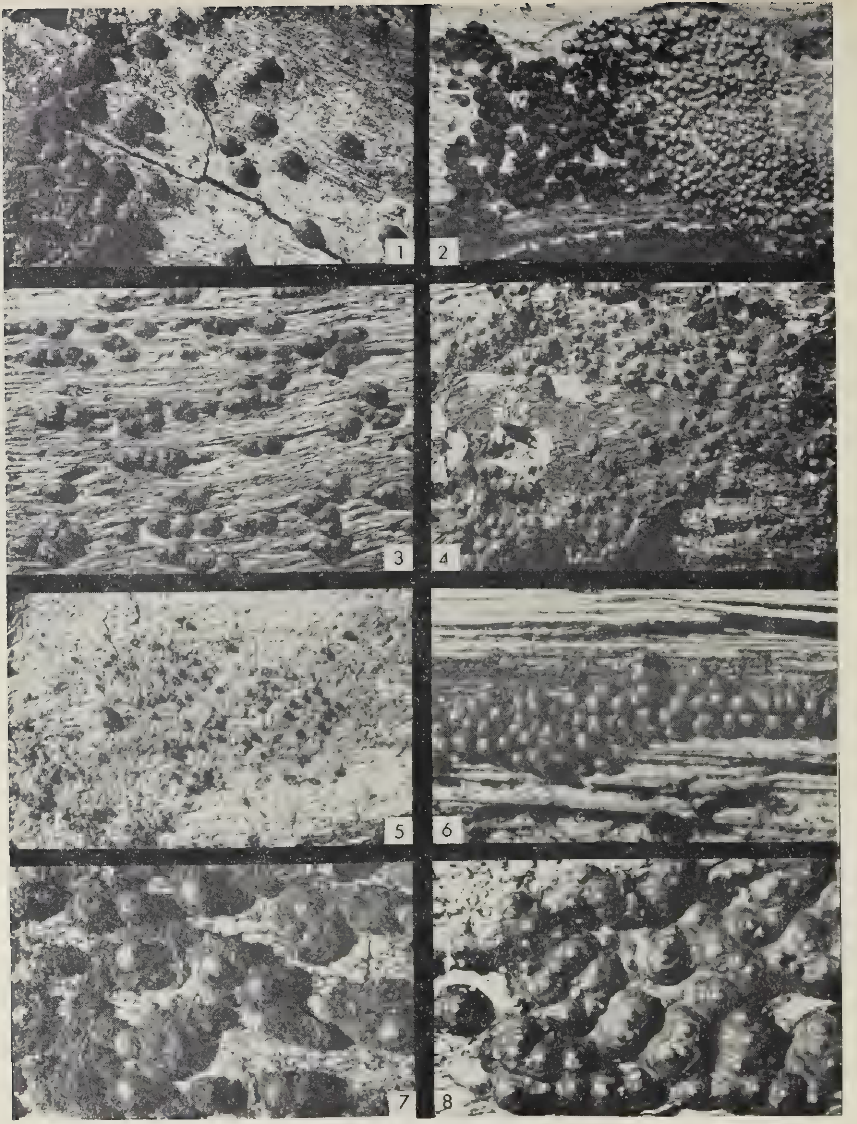


PLATE I. Stromata.
1—4×2·8, 5—8×3·5

1. *Hypoxylon mastoideum.*
2. *Hypoxylon chrysoconium:* immature stage at right.
3. *Hypoxylon ravenelii.*
4. *Hypoxylon entoleucum.*
5. *Hypoxylon minutissimum.*
6. *Hypoxylon perusensis.*
7. *Hypoxylon corticium.*
8. *Hypoxylon adumbratio.*

Cultural Characters (Plate III: 2).

Germination pattern radiate. Colonies mainly submersed to canescent, with sparse closely appressed white subhyaline aerial mycelium that is not more than 0·2 mm. high. Surface at first smooth, then with a characteristic coarse granulate surface. Margin submersed, almost colourless, entire, peripheral hyphae compact to somewhat dispersed. Conidia none. Stain variable, sometimes absent altogether but normally apparent after 14 days, at first light orange brown or amber yellow, then deepening to dull brown with age. Growth at 25°C moderate, 3·78 mm./day.

Cultures on maize and Czapek are less luxuriant, submersed except for scattered silky plumose filaments near the margin, and with a sodden aspect.

Microscopic Characters:

Primary mycelium with no distinguishing character, marginal hyphae with a maximum diameter of 1·5μ. No secondary mycelium.

5. *Hypoxylon serpens* (Pers. ex Fr.) Kickx.

Dennis, R. W. G. British Cup Fungi. 178, (1960), Kickx, J. Flora Crypt. Louvain. 115, (1835), Miller, J. H. Jour. Dept. Agric. Puerto Rico. **14**, 273, (1930), Miller, J. H. Trans. Brit. Mycol. Soc. **15**, 141, (1930), Miller, J. H. Mycologia. **25**, 327, (1933), (var. *macrosporum*), Miller, J. H. Monog. Univ. Puerto Rico. **B, 2**, 206, (1934), Shear, C. L. Mycologia. **20**, 87, (1928).

sub *Sphaeria serpens* Pers ex Fr. Fries E. M. Systema Mycologicum 341, (1823), Persoon C. H. Observationes Mycologicae, 18, (1796).

Stromata uniperitheciate and semicircular, or multiperitheciate and pulvinate to slightly effuse 0·6—21 × 0·6—75 × 0·3—1·7 mm., always superficial on bark or decorticated wood, grey to dull black in colour. Ectostroma evanescent and merging eventually with the carbonous entostroma that forms the bulk of the stroma; basal tissue pale, uncarbonised, small in quantity and closely following the line of the perithecial bases. Perithecia large, broadly globose, occupying most of the stromal interior, and evident in outline, 500—1400 × 450—900μ; large and small perithecia occur in the same stroma but usually those developing singly in a stroma are larger (1000—1400 × 650—900μ) than those developing severally (500—650 × 450—730μ). The perithecial wall is uncarbonized except for the ostioles and is often very difficult to distinguish from the surrounding tissue. The ostioles are typically papillate and sometimes spout shaped. In most cases a layer of ectostroma clearly forms the outer part of the ostiole; in others this layer is very thin. Asci clavate or cylindric, usually long stipitate, 81—215 × 5—10μ, stipes 24—90 × 2μ. Spores elliptic with rounded ends, slightly inequilateral, characteristically amber but also pale brown or brownish grey and subhyaline, or more rarely dark brown and opaque, $3{\cdot}5$—$8{\cdot}5 \times 8{\cdot}0$—$22{\cdot}5\mu$, av. $5{\cdot}4 \times 13{\cdot}2\mu$.

This writer regards *H. caries* as merely a small spored form of *H. serpens* and the distinction made by Miller (1961, pp. 80 and 81) between *H. serpens* normal type and the two varieties *var. effusum* and *var. macrospora*, to be of doubtful value, since there was usually a wide range of stromal form and spore size to be found within each example collected by the writer. Cultural work supports this view, there being no essential difference in character of a large number of strains.

Material examined: A large number of specimens in the IMI, Rijks & New York Herbaria: Martin 119, 280, 462, 483, 484, 495, 522, 524: Nature's Valley, Knysna District, Western Cape, South Africa (1958, 1959). Martin 227, 228, Hogsback, near Alice, Eastern Cape, South Africa (1958). Martin 272, 278; Alexandria Forest, Albany District, Eastern Cape, South Africa, (1958). Martin 660, 685; Yosemite National Park, California, U.S.A., (1961). Martin 696, 697, 713, 714, 715, 724, 725; Klamath, Northern California, U.S.A., (1961). Martin 739, 740, 741-756, 763, 780, 788; O'Brien, Northern California, U.S.A., (1961). Martin 792; Arcata, Northern California, U.S.A., (1961). Martin 1094; Columbia, Missouri, U.S.A., (1962). Martin 1132, 1145, 1146; Lake Ozark, Missouri, U.S.A., (1962). Martin 1533, 1576; San Blàs, Nayarit, Mexico, (1962). Martin 1599, 1615; Rockland County, New York State, U.S.A., (1963). Martin 1695; Conway State Forest, Mass., U.S.A., (1963). Martin 1704; Mt. Toby, Massachusetts, U.S.A., (1963). Martin 1767; ex Carroll, Univ. of Costa Rica Botanical Garden, San Pedro, Costa Rica, (1963). Martin 1800; ex Carroll, Kongedal, Sjaelland, Denmark, (1963).

Cultural Characters (Plate III: 4):

Germinating pattern free spreading. Colonies mainly submersed, with scant aerial closely appressed or canescent aerial mycelium which is usually hyaline and nearly colourless but white and opaque if occasionally developing in some quantity. Normally conidia are found abundantly soon after inoculation, so that the entire surface becomes characteristically fine granulate and ashy grey. In some cases however, where the conidia fail to develop, the mycelium has a sodden colourless aspect. Growth is normally uniform but sometimes ill defined zones 4—6 in number and 5—6 mm. wide appear, differing only in the concentrations of superficial conidia. The margin is usually distinct due to the absence of conidia, submersed, hyaline, colourless and entire; peripheral hyphae compact and closely parallel. Stain and carbonization none. Growth at 25°C very slow to moderate, 0·71—3·10 mm./day. Cultures on maize are less luxuriant and Czapek cultures grow extremely poorly, submersed with a sodden aspect.

Microscopic Characters:

The primary mycelium has a maximum diameter of 2·9μ, and an interesting though inconsistent feature is the undulating form of the marginal hyphae. Secondary mycelium nil.

Conidiophores and conidia:

The conidiophores comprise an indefinitely branched system 180—1050 × 1·2—3·0μ of which the terminal hyphae and parts of the main branches of the mycelium are fertile. The branches arise from over the length, or at least the upper half of, the primary axes. Apart from the production of conidia, the conidiophores can often be distinguished from the vegetative mycelium by ternate branching and are usually variable in length, 4—128 × 1·6—4·3μ. The fertile hyphae are geniculate, and either bear conidia along short spicate terminal portions, or in apical clusters. The latter clearly represents a shortening of the fertile axis. The conidia are sessile, usually borne in 4 rows corresponding to the outward elongation of the tip of the fertile hyphae in 4 different directions, but may also be borne without apparent order. They are small, equilateral oval, with both ends rounded or with truncate bases, hyaline individually but deep cineraceous grey when seen collectively, and measure 1·4—3·1 × 2·5—6·3μ, ave. 2·4 × 3·6μ.

6. **Hypoxylon cuneosporum** Martin, sp. nov.

Stromata aplanopulvinate or globose, 1·8—4·4 × 1·9—20 × 0·7—1·2 mm., superficial on bark or wood, but normally the former (Plate II:5). Surface of stroma smooth, dull black. Carbonous layer of the entostroma predominant, basal tissue well developed at maturity, corky, white and usually conspicuous. Perithecia globose, 300—400 × 500—600μ, ostioles papillate and usually clearly visible on the surface of the stroma. Asci cylindric, usually long stipitate, 90—150 × 6μ, stipes 35—75μ. Spores oval, inequilateral with one end slightly conical, pale brown, 3·5—7·0 × 9·5—14·5μ, ave. 5·0 × 11·7μ.

South African Hosts: Primarily *Olea capensis*, also occasionally other species unfortunately unidentifiable.

This species is close to *H. serpens* but differs in the greater development of basal tissue, and in the rather peculiar subconical spores.

Material examined: Martin 302, 345, 513, 514; Nature's Valley, Knysna District, Western Cape, South Africa (1958, 1959).

Cultural Characters (Plate III: 8):

Germination pattern free spreading. Colonies at first submersed for the first 10 days of growth then sparingly canescent, white subhyaline. Margin distinct submersed, entire, some 2—3 mm., broad, sometimes gelatinous in aspect, with compact peripheral hyphae. Conidia abundant, greenish-grey, produced almost immediately, certainly before the colony is a week old. Stain and carbonization none. Growth at 25°C very slow, 0·93 mm./day.

Microscopic Characters:

Primary mycelium not diagnostic; maximum diameter of the marginal hyphae $= 2\cdot1\mu$. No secondary mycelium.

Conidiophores and conidia (Fig. II: 18):

Conidiophores not clearly distinct from the vegetative mycelium except for the ternate branching; 100—150μ long and $2\cdot0\mu$ wide. The fertile branches are long, uniseptate, 40—$65\times1\cdot5$—$2\cdot1\mu$; fertile part rather indefinite in extent, occasionally divided by an intercalary sterile portion but usually occupying 1/5—3/5 of the fertile branch and ranging from 10—40μ in length. Conidia mainly pleurogenous, sessile, borne singly or on geniculate protrusions, and arranged spirally in 4 rows. They are hyaline, greenish-grey *en masse*, oval, with both ends rounded, $1\cdot4$—$2\cdot3\times2\cdot6$—$4\cdot6\mu$, ave. $1\cdot9\times3\cdot3\mu$.

7. *Hypoxylon quadratum* (Schw.) Ell. & Ev.
   Ellis, J. B. & B. M. Everhart N. Amer. Pyren. 631, (1892), Miller J. H. World Species of *Hypoxylon* 61, (1961).

sub *Hypoxylon kellermanni* Rehm. Rehm, H. Ann. Mycol. **6**, 313, (1908).

sub *Hypoxylon regale* Morgan. Miller J. H. Mycologia **25,** 328, (1933), (var. *macrosporum*), Miller, J. H. World Species of *Hypoxylon* 67, (1961). Morgan, A. P. Journal of Mycology **10,** 162, 1904.

sub *Sphaeria quadrata* Schw. Schweinitz, L. v.d. Trans. Amer. Phil. Soc. Philad. **4,** 194, 1832.

Stromata pulvinate globose, 1—3 mm. wide or long and 3—4 mm. high, formed superficially on bark only (Plate II: 6). Surface of stroma smooth, grey-brown to black, normally dull but sometimes shiny with extreme age. Entostroma mainly carbonaceous and very thick; basal tissue corky, rather slight, conspicuous up to maturity but disintegrating with age. Perithecia 2—5 per stroma and occupying most of it, 530—600×700—800μ; ostioles indistinctly papillate. Asci cylindric or clavate, with stipes of moderate length, 125—200×10—18μ, stipes 25—70μ. Spores oval with rounded ends, dark brown, $8\cdot0$—$14\cdot5\times16\cdot5$—$29\cdot5\mu$, ave. $10\cdot4\times21\cdot9\mu$. The writer regards *H. regale* and *H. quadratum* as identical, as the former separation based on spore size is too unreliable.

South African Hosts: *Olea capensis*

Material examined:

sub *Hypoxylon argillaceum* Morgan; on *Fraxinus*, Miami Valley, Ohio, U.S.A., (1894), (NYBG).

sub *Hypoxylon quadratum* Martin 21, 122, 225, 286, 1008, 1052; Nature's Valley, Knysna District, Western Cape, South Africa, (1958, 1962). Miller 4906, = Morgan 6061; on *Fraxinus*, U.S.A., (Mill.).

sub *Hypoxylon regale* Miller; on *Quercus*, Mountain City, Georgia, U.S.A., (1929), (Mill.).

Cultural Characters (Plate III: 7):

Germination pattern free spreading. Colonies submersed at first, sometimes for a considerable time, later canescent and appressed, colourless and almost hyaline. Margin entire and compact. Conidia produced after 32 days in bottle culture, absent from plate culture, forming a thin greenish-grey superficial mat. Stain dark purple in bottle culture, absent from plate culture. Growth at 25°C very slow, 1·09 mm./day. Cultures on maize, malt and Leonian's agars are grossly similar, but cultures on Czapek remain almost completely submersed and have a gelatinous surface.

Microscopic Characters:

Primary mycelium undiagnostic. Maximum diameter of the marginal hyphae $= 2{\cdot}0\mu$. No secondary mycelium.

Conidiophores and conidia (Fig. II: 19):

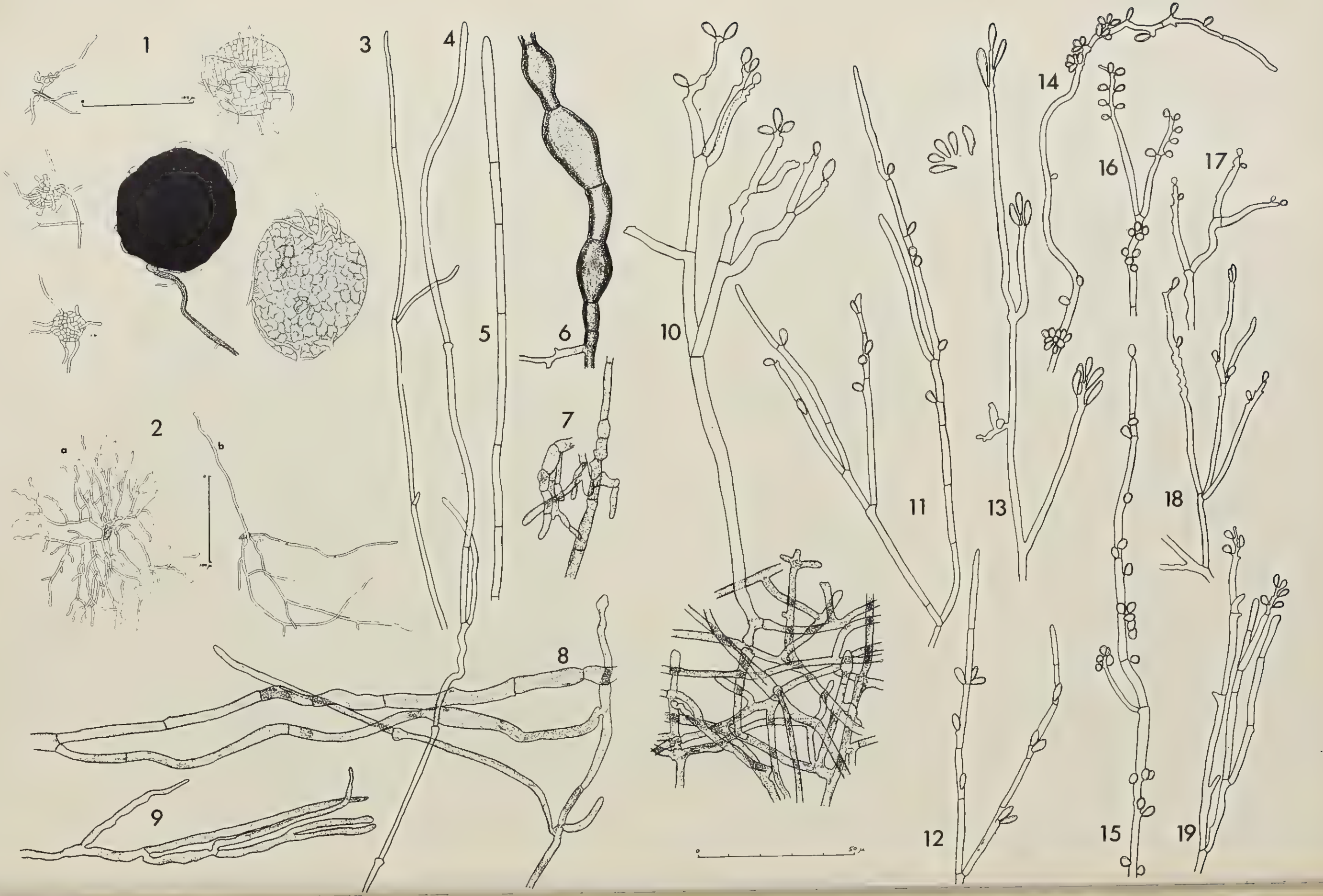
Conidiophores not clearly distinct from the vegetative mycelium, indefinitely dichotomously branched, $100—150 \times 2{\cdot}0\mu$; fertile branches relatively short, $26—40 \times 2{\cdot}0—2{\cdot}5\mu$, geniculate, normally unseptate but sometimes with one or two septae. Conidia acropleurogenous, each seated on a geniculate protrusion, apparently in spiral formation in 2 rows, subglobose to spherical, fawn-grey collectively, $2{\cdot}0—2{\cdot}9 \times 2{\cdot}6—3{\cdot}7\mu$, ave. $2{\cdot}5 \times 3{\cdot}1\mu$.

8. *Hypoxylon smilacicolum* (Schw. ex Fr.) Howe.

Ellis, J. B. & B. M. Everhart Jour. Myc. **4**, 70, (1887), Ellis N. Amer. Pyren. 642, (1892), Howe, E. C. Bull. Torrey. Bot. Club. **6**, 31, (1875), Miller, J. H. World Species of *Hypoxylon*, 70, (1961).

sub *Sphaeria smilacicola* (Schw. ex Fr.). Fries, E. M. Elenchus fungorum 11, 71, (1826), Schweinitz, L. Trans. Amer. Phil. Soc. Philad. N.S. **4**, 196, 226, (1832).

Stromata very small, pulvinate or globose, uniperitheciate or more commonly multiperitheciate, but with complete immersion of the perithecia


a
b
50 µ

in the stroma; 0·4—1·5×0·4—4·5×0·4—0·7 mm. (Plate II: 1, 2). Colour dull black, never shiny. Outer entostroma a thin carbonous crust; basal tissue fairly well developed, light brown (Fig. 1:2). Perithecia ovoid or conic, often flattened by mutual pressure, 170—400×350—550μ; ostioles indistinctly papillate. Asci clavate, short stipitate, 100—130×9—10μ, stipes 25—40μ. Spores oval elliptic, slightly inequilateral, 4·5—8·5×11·0—17·5μ, ave. 6·9×15·5μ.
South African Hosts: Wood, unidentifiable but probably monocotyledonous.

Material examined: Howe; on dead *Smilax*, Yonkers, N.Y. State, U.S.A. In Herb. Leroy, (pre 1898), (NYBG). Martin 396; Highlands, Albany District, E. Cape, South Africa (1959).

Cultural Characters (Plate IV: 9):

Germination pattern free spreading. Colonies at first (up to 7 days) finely canescent with scant subhyaline white aerial mycelium and a silky aspect especially near the margin, later becoming denser. Bottle cultures are weakly zonate or uniform, plate cultures strongly zonate, each zone 2 mm. wide and 5—7 mm. apart, consisting of an undulating irregular ridge of velvet white mycelium bearing sparse conidia. The central zone is the most regular and conspicuous. The mycelium between the zone is almost hyaline and closely appressed. The general surface of the colony is smooth or undulating and tends to be slightly gelatinous in aspect. Margin distinct, 4—13 mm. wide, submersed appressed, irregular and characteristically segmented, each segment 5—15 mm.

Fig. II. Mycelial Characters and Imperfect Stages.
1. *Hypoxylon entoleucum:* Stages in development of carbonous sclerotia.
2. Germination patterns: *a*) radiate: *Hypoxylon mastoideum.*
   b) free spreading: *Hypoxylon entoleucum*
3—5. Marginal hyphae, showing differences in diameter.
   3. *Hypoxylon entoleucum.*
   4. *Hypoxylon albocinctum.*
   5. *Hypoxylon corticium.*
6—9. Types of secondary mycelium.
   6. *Hypoxylon corticium:* bulbous hyphae within reticulate system.
   7. *Hypoxylon adumbratio:* close aanstomosed.
   8. *Hypoxylon albocinctum:* loose.
   9. *Hypoxylon sassafras:* slightly ropy.
10. *Hypoxylon corticium:* conidiophore on subiculum developed experimentally.
11—19. Conidiophores and conidia: *Nodulisporium* types I and II.
   11. *Hypoxylon albocinctum:* Type I.
   12. *Hypoxylon pynaerthii:* Type I.
   13. *Hypoxylon adumbratio: Nodulisporium* type IIa, strongly monopodial.
   14. *Hypoxylon entoleucum:* Type I.
   15. *Hypoxylon discolor:* Type I.
   16. *Hypoxylon sassafras: Nodulisporium,* intermediate between types I and II.
   17. *Hypoxylon smilacicolum:* Type II.
   18. *Hypoxylon cuneosporum:* Type II.
   19. *Hypoxylon quadratum:* Type II.

wide. Peripheral hyphae compact. Conidia white, very sparse, and restricted to the zones so that they are practically indistinguishable from the surrounding mycelium. Stain and carbonization nil. Growth at 25°C slow, 1·90 mm./day. Cultures on maize and Czapek are less luxuriant than on malt.

Microscopic Characters:

Primary mycelium not diagnostic; marginal hyphae rather narrow with a maximum diameter of 1·7μ. Secondary mycelium nil.

Conidiophores and conidia (Fig. II: 17):

The conidiophores are very short, branched dichotomously to the first or second degree at the distal end, easily distinct from the vegetative mycelium by their determinate growth and slightly wider diameter, 60—220 × 2·5μ; each usually bifurcate, producing 2 ultimate fertile branches 21—30 × 1·7—2·3μ bearing very shortly spicate or capitate clusters of conidia. Interesting peculiarities are the irregularly swollen axes of the conidiophores, and the broad V-shape of dichotomous branching. The conidia are sessile, relatively small, oval to subglobose, often wide truncate bases, white, 1·1—1·7 × 1·7—5·2μ, ave. 1·5 × 2·1μ.

9. *Hypoxylon sassafras* (Schw. ex Fr.) Curt.

Berkeley, M. I. Grevillea **4,** 52, (1875), Cooke, M. C. Ann. N.Y. Acad. **1,** 184, (1878), Currey, F. Trans. Linn. Soc. Lond. **22,** 267, (1859), Curtis, M. A. Geol. & Nat. Hist. Survey of North Carolina III, 140, (1867), Ellis, J. B. & B. M. Everhart Jour. Mycol. **4,** 70, (1887), Ellis, J. B. & B. M. Everhart N. Amer. Pyren. 641, (1892), Miller, J. H. World Species of Hypoxylon **21**, (1961), Owens, C. E. Proc. Indiana Acad. Sci. **1911,** 307, (1912), Penzig, O & P. A. Saccardo Malpighia **11,** 493, (1897), Rehm, H. Hedwigia **21,** 138, (1882), Shear, C. L. Mycologia **20,** 86, (1928), Sydow, H. & F. Petrak Ann. Mycol. **20,** 184, (1922),

sub *Hypoxylon bifrons* Ces. & DN. De Notaris, G. Hedwigia **2,** 171, (1863), De Notaris, G. Sphaeriacei Italici **18,** (1863), Saccardo, P. A. Fungi Ital. 579, (1877-1886), Traverso, J. B. Flora Ital. Crypt. **1,** 45, (1906).

sub *Hypoxylon callostroma* (Schw.) Berk. Berkeley, M. J. Grevillea **4,** 51, (1875), Ellis, J. B. & B. M. Everhart Jour. Mycol. **4,** 69, (1887), Ellis, J. B. & B. M. Everhart N. Amer. Pyren. 643, (1892).

sub *Sphaeria callostroma* Schw. Schweinitz, L. v.d. Jour. Acad. Nat. Sci. Philad. **5,** 15, (1825), Schweinitz, L. v.d. Trans. Amer. Phil. Soc. Philad. N.S. **4,** 192, (1832).

sub *Sphaeria sassafras* Schw. Fries, E. M. Systema Mycologicum II, 343, (1823), Schweinitz, L. v.d. Syng. Fun. Carolinea Sup. **36,** (1822).

Stromata erumpent though decorticated wood or bark, aplanopulvinate, 1·2—8 × 2·0—2·6 × 1·2—2·5 mm. (Plate II: 7). Surface of stromata often depressed by shallow concavities. Outer entostroma thin, dark and carbonous, inner basal tissue predominant, corky to somewhat fleshy, brilliant yellow orange. Perithecia 1 to several per stroma, large, 500—1300 × 700—1300μ, occupying the major part of the stroma; ostioles punctate, indistinct. Asci cylindric, long stipitate, 170—240 × 3—6μ, stipes 80—130μ long. Spores cylindrical elliptic, equilateral, ends broadly rounded, pale brown, 3·0—5·5 × 10·5—14·0μ, ave. 3·9 × 10·2μ.

South African Hosts: Curtisea faginea, decorticated wood. In North America this species shows strong preference for *Umbellularia californica*.

Material examined: A large quantity of material in the AA, NFC and NYBG herbaria. Martin 390; Nature's Valley, Knysna District, Western Cape, (1958). Martin 661; Yosemite, California, U.S.A., (1961). Martin 773, 774; O'Brien, California, U.S.A., (1961). Martin 1602, 1626; Rockland Co., NY State, U.S.A., (1963).

Cultural Characters: (Plate IV: 10):

Germination pattern free spreading. Colonies appressed canescent to sparsely felty, white to pale grey, sometimes with a brownish tinge, subhyaline to opaque; divided during early stages of growth into a submersed marginal zone up to 5 mm. wide and a centre with distinct aerial growth, later becoming zonate with up to 5 zones each 2 mm. wide and about 5 mm. apart. Margin entire, compact, 2—3·5 mm. wide. Conidia appear only with extreme age, between 4 and 8 weeks after inoculation, in small pulvinate masses over the centre of the colony, and are dark nondescript brownish in colour. Stain none. Growth at 25°C very slow, 0·95 mm./day.

Microscopic Characters:

Primary mycelium not diagnostic; maximum diameter of the marginal hyphae—2·1μ. Secondary mycelium very sparse in quantity, developing in small areas under the white primary mycelium, and is characteristically loosely organised, or slightly ropy, indefinitely branched dichotomously with few anastomoses; 1·3—3·8μ diam. (Fig. II: 9).

Condiophores and conidia (Fig. II: 16):

The conidiophores are somewhat difficult to distinguish from the vegetative mycelium except for their pale amber colour and closer branching; each forms an indefinitely dichotomously branched unit 150—300 × 3·1μ with ultimate fertile branches 17—81 × 1·2—2·4μ, sparingly septate. The conidia are borne ubiquitously in small sessile fascicles of 2—3 or singly, on geniculate prominences or from the smooth wall of the sides and ends of the fertile branches. The conidia are oval to subglobose with narrow truncate bases, pale ochre brown collectively, 1·7—2·9×1·7—3·7μ, ave. 2·2×3·0μ.

10. *Hypoxylon discolor* Berk. & Br.

Berkeley, M. J. & C. E. Broome Jour. Linn. Soc. **14,** 123, (1875), Petch, T. Ann. Roy. Bot. Gard. Perad. **8,** 155, (1924).

sub *Penzigia discolor* (B. & Br.) Mill. Miller, J. H. Bothalia **4,** 261, (1942).

Stromata pulvinate, usually densely aggregated, 0·7—4·4×0·7—8·0× 0·6—0·8 mm., sessile or attached to the substrate at a central point only, superficial on wood or decorticated wood and bark (Plate II: 8). Ectostroma at first scabrous and corky, dirty white, later grey and merging with the carbonous entostroma; basal tissue of the entostroma predominant, white or sulphur yellow (Fig. I: 1). Perithecia few per stroma, relatively large, occupying most of the stromal interior, 400—600×400—500μ; ostioles distinctly papillate. Asci not seen. Spores broadly oval, dark brown 4·5—8·5×9·0—13·5μ, ave. 6·6×11·2μ.

South African hosts unidentifiable, but obviously comprising a great range.

Material examined:

sub *Hypoxylon discolor.* ex Herb. Massee 310, Ceylon (pre-1905), (NYBG).

sub *Penzigia discolor* ex Pretoria Herb. 31062, 32149, (Pret.). Martin 365, 380, 454, 512; Nature's Valley, Knysna District, Western Cape, South Africa, (1958, 1959).

Cultural Characters (Plate IV: 12):

Germination pattern free spreading. Colonies velvet fleecy, gleaming white, opaque to subhyaline, very dense, forming a closely knit mat up to 2 mm. high with a coarse surface. A characteristic ruff of mycelium is formed encircling the centre of the colony and 5 cm. away from it; growth otherwise ranges from uniform to zonate with 1—3 zones developed irregularly surrounding the centre. Margin submersed to canescent, entire, with compact peripheral hyphae up to 4 mm. wide. Conidia appear late, in bottle culture 9 months after inoculation, and are very pale fawn-grey over small areas of the mycelium. Stain none, carbonization none. Growth at 25°C slow, 1·80 mm./day. Cultures on maize and Czapek are less luxuriant than on malt.

Microscopic Characters:

Primary mycelium undiagnostic; maximum diameter of the marginal hyphae = 2·9μ. Secondary mycelium uniformly dispersed, consisting of long, sparingly branched and loosely anastomosed filaments 2·7—4·3μ diameter.

Conidiophores and conidia (Fig. II: 15):

Conidiophores are indistinguishable from the vegetative mycelium except for bearing spores and are branched dichotomously to the first degree over the length of the primary axes, and measure 300—500 × 2·9μ. Conidia arise off the flat surface of the hyphae and not off geniculate protuberances. The fertile branches are 25—115μ × 1·2—2·6μ, sparingly septate; conidia acropleurogenous, sessile, borne singly or in groups of 4—9 along their entire length, oval to subglobose, pale fawn-grey collectively, 2·3—3·7 × 2·9—4·8μ, ave. 2·8 × 3·7μ.

11. *Hypoxylon cadigensis* Yates.

Yates, H. S. Phillipp. Journ. Sci. **12,** 378, (1917).

Stromata pulvinate, small, 0·8—1·6 × 1·0—2·2 × 0·9—1·1 mm., attached to the substrate at a central point only, superficial on bark. Ectostroma scabrous in the form of polygonal crusts, corky and dull brown, basal tissue of the entostroma very conspicuous, pure white. Perithecia few per stroma, either vaguely evident or immersed, 500—600 × 600—700μ; ostioles medium papillate. Asci cylindric with conspicuously thick walls, 135—150 x 10—16μ, stalks 37—42μ. Spores oval, inequilateral with one side straight or convex, opaque black, with very conspicuous gelatinous sheaths and spiral germ slits, 8·5—10·5 × 17·0—20·0μ, ave. 9·6 × 18·2μ.

South African Hosts: unidentified bark.

Material examined: Martin 1039; Nature's Valley, Knysna District, Western Cape, South Africa, (1962). Rogers 1616; Jaluit Atoll, Marshall Islands, (1946), (NYBG).

This species did not germinate successfully so that no cultural information is available.

12. **Hypoxylon entoleucum.** Martin nov. sp.

Stromata aplanate crustose, consisting of a thin corky matrix with a carbonous veneer, 10—23 × 41 × 0·5—0·6 mm. (Plate I:4). The perithecia are aggregated but not coalesced, and are clearly evident in outline on the surface of the stroma. Ectostroma evanescent; outer layer of entostroma carbonaceous and also tending to disintegrate with age; basal tissue well developed, pure white. The stroma, although closely appressed to the host bark is actually in connection with it at only a few places where the dark secondary mycelium below the entostroma enters for a short distance. Perithecia globose, 400—650 × 400—500μ, often broader than deep; ostioles indistinctly papillate. Asci not seen. Spores elliptic navicular with rounded or bluntly pointed ends, light brown, 5·0—8·5 × 14·0—19·0μ, ave. 6·4 × 16·4μ.

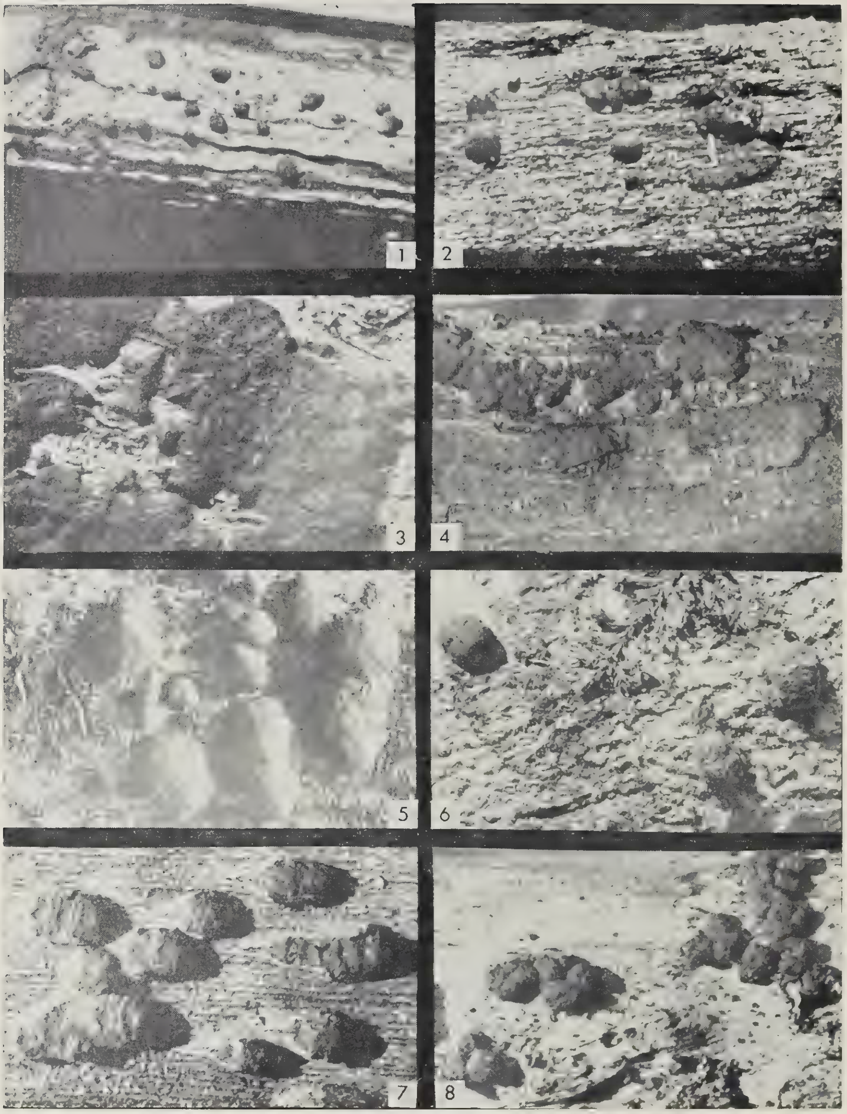


PLATE II. Stromata contd.
1 × 2·3, 2—8 × 3·5

1, 2. *Hypoxylon smilacicolum.*
3. *Hypoxylon albocinctum.*
4. *Hypoxylon pynaerthii.*
5. *Hypoxylon cuneosporum.*
6. *Hypoxylon quadratum.*
7. *Hypoxylon sassafras.*
8. *Hypoxylon discolor.*

South African Hosts: Cassine croceum, bark.

Material examined: Martin 362; Nature's Valley, Knysna District, Western Cape, South Africa, (1958).

Cultural Characters (Plate III: 9):

Germination pattern free spreading (Fig. II: 2b). Colonies velvet silky to thin felty with a coarse surface, dull white to pale grey, with flat fawn coloured irregular conidial areas 3 mm. high developed in bottle culture. An abundance of coal black bodies produced by the mycelium may become conspicuous with age. Margin entire or cast into small segments, submersed to canescent, compact. No stain or carbonization. Colonies on maize and Czapek are more effuse than on malt and Leonian's agar.

Microscopic Characters:

Maximum diameter of the marginal hyphae = $1 \cdot 7\mu$ (Fig. II: 3). Secondary mycelium absent. The feature which distinguishes this species from all others investigated except *H. truncatum* is the production of coal black carbonous bodies over most of the surface of the mycelium (Fig. II: 1). Small aggregations of hyphae develop just behind the colony margin. These develop later into white pseudoparenchymatous spheres about 30μ diameter. About 24—36 hours after initiation these spheres expand, losing all evidence of cellular structure and many of the hyphal contacts with surrounding mycelium. The remaining hyphae swell up to about 6μ in diameter, turn amber, and may develop wall pitting. The colour of the sphere changes to pale brown and then, as carbonization takes place, to jet black. The fully formed spheres are evident after 2—2½ days, range from 100—130μ in diameter, and have a rigid exterior enclosing a centre that is hollow or filled with loose cells.

Conidiophores and conidia (Fig. II: 14).

The conidiophores are similar to those of *H. discolor* in that they cannot be distinguished from the vegetative mycelium. They form an indefinite dichotomously branched system 200—300μ long; with ultimate fertile branches 130—230μ long, sparingly septate and bearing sessile conidia in small fascicles of 5—8 along their length and singly on geniculate prominences near their ends. Conidia oval, fawn-grey collectively, $1 \cdot 7$—$2 \cdot 9 \times 3 \cdot 1$—$4 \cdot 6\mu$, average $1 \cdot 9 \times 3 \cdot 7\mu$.

13. **Hypoxylon minutissimum** Martin, nov. sp.

Stromata minute, globose, uniperitheciate, but gregarious on the surface of decorticated wood, and dull black in colour (Plate I: 5). Perithecia 200—300μ (wide) $\times$ 150—250μ (high) ostioles papillate, indistinct. Asci clavate, short stipitate, 75—90×8μ, stipes 18—21×3μ. Spores oval to subglobose, light brown, 5·0—8·0×6·0—10·5μ, ave. 6·2×8·5μ.

Material examined: Martin 269; on decorticated wood of *Acacia karoo*, near Alexandria, Eastern Cape, South Africa, (1958).

Cultural Characters (Plate IV: 1, 3):

Germination pattern radiate. Colonies velvet felty, uniformly dense, with very fine smooth surface. Aerial mycelium gleaming white, up to 3·5 mm. high near the centre and thinning gradually towards the margin and consequently turning from opaque to subhyaline. The margin is usually distinct as a zone 3 mm. broad, canescent, white, subhyaline and entire. Marginal hyphae are compact and run closely parallel. Conidia none. Stain and carbonization none. Growth at 25°C slow, 2·06 mm./day. Cultures on maize and Czapek are less luxuriant at first than on malt. Czapek bottle cultures develop deep surface wrinkling and exude olivaceous droplets with age while olive yellow stain develops on the reverse. Leonian's bottle cultures develop carbonization but no stain.

Microscopic Characters:

Primary mycelium undistinguished, marginal hyphae with a maximum width of 1·4μ; secondary mycelium nil.

14. **Hypoxylon mastoideum** (Fr.) Martin comb. nov.

sub *Psilosphaeria mammoidea* Cooke: Cooke, M. C. Grevillea **8,** 67, (1897).

sub *Rosellinia mammoidea* (Cke) Sacc. Massee, G. Kew Bull. **1898,** 129, (1898), Saccardo, P. A. Syll. Fung. **1,** 263, (1882).

sub *Rosellinia mastoidsea* (Fr.) Sacc. Bresadola, G. & Saccardo, P. A. Malphighia **11,** 284, (1897), Saccardo, P. A. Syll. Fung. **1,** 258, (1882), Traverso, J. B. Flor. Ital. Crypt. **1,** 459, (1906).

sub *Sphaeria mastoidea* Fr.: Berkeley, M. J. Mag. Zool. & Bot. **6,** 362, (1841), Cooke, M. C. Handbook of British Fungi **11,** 868, (1871), Durieu de Maisonneuve & Montagne, J. F. C. Explor. Alger. **1,** 504, (1846), Fries, E. M. Syn. Scler. Suec. **39,** (1823).

Stromata very variable, uniperitheciate, biperitheciate or with several perithecia aggregated under the same stromal covering in ranging degrees of proximity; 0·5—4×0·5—10×0·8—1·6 mm.; colour usually shiny black (Plate I: 1). The similarity of uniperitheciate stromata to the perithecial units of aggregate stromata makes it hard to recognise more than one species although many authors have obviously done so. Outer entostroma hard black and carbonous, merging gradually into the basal tissue which is brown and uncarbonized. Perithecia globose or semicircular due to broadening of the bases, 400—1400×700—1500μ; ostioles papillate and usually distinct. Asci clavate, 100—130 × 11μ; stipes variable but usually short, 21—65 × 3μ. Spores equilateral, oval-elliptic with rounded ends, dark brown, 5·0—10·5 × 10·0—22·0μ, ave. 7·6 × 14·5μ. There is probably a very wide host range; unfortunately much of the substrate could not be identified with certainty. The following South African hosts are definitely known: *Olea capensis, Cassine croceum, Gonioma kamassi, Sideroxylon inerme.*

Material examined:

sub *Hypoxylon mastoideum.* Martin 9, 11, 20, 27, 36, 42, 47, 81, 94, 233, 347, 348, 431, 433, 460, 466; Nature's Valley, Knysna District, Western Cape, South Africa, (1958, 1959). Martin 414; Alexandria Forest, Albany District, Eastern Cape, South Africa, (1958). Martin 531; Highlands, Albany District, Eastern Cape, South Africa, (1959). Martin 986, 1527; San Blàs, Nayarit, Mexico, (1961, 1962). Martin 1126, 1175; Lake Ozark, Missouri, U.S.A., (1962).

sub *Hypoxylon semi-immersum.* Blackwell; in Herb. IMI. 53, 998; Mulgrave Woods, Yorks., England, (1953), (CMI).

sub *Rosellinia mammoidea.* Parks; in Herb. NFC. 22488, (1929), (NFC).

sub *Rosellinia mastoidea.* Kopf & Rogers; in Herb. Rogers 3145, on *Aleurites moluccana*, Mannali Gulch, Lauai, Hawaii, (1947), (NYBG). D. Saccardo; Mycotheca italica 1476 on *Salvia offcinalis*, Rome, (1904), (NYBG).

Cultural Characters (Plate IV: 2, 4, 5):

Germination pattern radiate (Fig. II: 2a). Colonies fleecy to velvet lanose, gleaming white, changing little with age or becoming tinted light yellow-brown, uniform or zonate with up to 3 zones, each 2 mm. wide and 5 mm. apart after 7 days, growth. The degree of luxuriance varies with the strains; the hyphae, always densely packed, range from 3 to 15 mm. in height. With age some strains produce marginal plumes of hyphae that serve as a distinguishing characteristic. Margin variable in character, either not clearly distinct, appressed and rising abruptly into the rest of the colony, or up to 3 mm. broad, submersed, colourless, lobed or entire, and compact. Conidia infrequently produced, usually with age, after 3 weeks (plate culture) or 10 months (bottle culture); pale fawn-grey. Stain and carbonization none. Growth at 25°C very slow, 0·92—1·13 mm./day. Cultures on maize are less luxuriant, and those on Czapek grow poorly, almost completely submersed initially.

Microscopic Characters:

Primary mycelium undistinguished, marginal hyphae with maximum width of 2·0μ. Secondary mycelium nil.

Conidiophores and conidia:

Conidiophores belong to both types of *Nodulisporium* type II previously described (Martin 1967). The conidiophores are branched to the second degree over most or all of the primary axes. In Type IIa the branching is dichotomous, and the system ranges from 200—300 in length while the ultimate fertile branches are 30—80 × 1·2—1·8μ. In Type IIb. the conidiophores are more clearly recognizable as units ranging from 150—250μ in length, and the ultimate fertile branches are 37—75μ × 1·2—1·8μ. The branching is characteristically ternate, and the fertile portion of the ultimate branches is characteristically geniculate.

Conidia in all cases are sessile, produced in short spicate apical clusters without apparent order, and are oval to subglobose, wide based, with rounded. ends pale fawn-grey collectively, 1·4—2·3 × 2·0—4·0μ, ave. 1·8 × 2·7μ.

15. *Hypoxylon albocinctum* E. & E.

Ellis, J. B. & B. M. Everhart Proc. Nat. Acad. Sci. Philad. **III 20,** 229, (1890), Miller, J. H. World Species of *Hypoxylon* 77, (1961). Shear, C. L. Lloydia **8,** 248, (1945).

sub *Hypoxylon hydnicolum* (Schw.) Sacc. Ellis, J. B. & B. M. Everhart North Amer. Pyren. 657, (1892), Saccardo, P. A. Syll. Fung. **1,** 383, 1882.

Stromata aplanopulvinate to effuse, 2·2—19 × 3·0—53 × 0·5—1·8 mms., sometimes with a rather indistinct outline; surface flat or nearly so, in contrast to *H. serpens*, since the perithecia do not appear above the stromal surface (Plate II: 3). Colour dull or shiny black. Ectostroma and entostroma similar to that in *H. serpens*. Perithecia normally densely clustered in the stroma and sometimes flattened laterally by mutual pressure, ovoid to conic, 200—800 × 400—1000μ; ostioles papillate or indistinct, not as conspicuous as in *H. serpens*. Asci cylindric, or slightly clavate, very variable in total length depending on the extent of the stipes, 65—180 × 5—11μ; stipes 20—100 × 3μ. Spores oval, equilateral, light or dark brown, the latter usually opaque, 3·0—7·5 × 6·5—15·0μ, ave. 5·8 × 11·9μ.

There is a very wide range of hosts. Known South African hosts are*: Olea capensis, Cassine crocea, Vepris lanceolata.*

Material examined: A large number of species in the CMI, Rijks and New York Herbaria. Morgan 884; on *Crataegus*, Preston, Hamilton Co., Ohio, U.S.A., (1890), (NYBG). Martin 129, 153, 397, 581, 582; Fernkloof, Grahamstown, E. Cape, South Africa, (1959, 1960). Martin 150, 309, 324, 335, 336, 338, 368, 375, 403, 517, 576, 578, 1019; Nature's Valley, Knysna District, Western Cape, South Africa, (1958—1962). Martin 577; Wilderness, Knysna District, Western Cape, South Africa, (1959). Martin 586; Alexandria Forest, Eastern Cape, South Africa, (1960). Martin 614; Los Angeles, California, U.S.A., (1961). Martin 899; ex C. Booth. CMI, Surrey, England, (1961). Martin 909, 934; Mazatlàn, Sinaloa, Mexico, (1961). Martin 970, 980, 988, 989, 992, 1573; San Blàs, Nayarit, Mexico, (1961, 1962). Martin 1168; Lake Ozark, Missouri, U.S.A. (1962). Martin 1604, 1616, 1617, 1622; Rockland Co., N.Y., U.S.A., (1963).

Cultural Characters (Plate IV: 8, 11):

Germination pattern free spreading. Colonies at first velvety (1—5 days) later becoming velvet lanose with various degrees of luxuriance. The aerial mycelium forms a dense opaque white mat up to 4 mm. high with a fine smooth surface and normally with a pronounced "pile". Growth ranges from completely uniform to strongly zonate; in the latter case 4—6 zones each 2 mm. wide and 4—10 mm. apart were formed in 2 weeks. The zones are clearly formed by the repeated unequal development of the peripheral hyphae, some of which grow faster than the others and increase the diameter of the colony, while the remainder form a ruff on the surface of the colony. While the new zone is consolidated by ramification of the original pioneer hyphae, fresh hyphae grow out to form the next zone. The surface of the colony varies from strictly even to irregular and cushiony in aspect. The margin is entire or evenly segmented and may be distinct from the interior of the colony as a canescent or submersed zone 4—15 mm. broad, but is more commonly formed of dense aerial appressed hyphae that rapidly merge into the velvet growth behind. The marginal hyphae are extremely compact. Conidia are infrequently produced, after about 3 weeks in plate culture and between 1 and 8 months in bottle culture. They are white or light fawn in colour, and cover most of the surface of the colony, though not nearly as extensively as in *H. serpens.* Stain nil; "carbonization" of the substrate occurs in bottle culture but not in plate culture, after 2 months, to a variable extent, forming a dark crust 2 mm. deep beneath the aerial mycelium. Growth at 25°C very slow to moderate, 1·20—3·03 mm./day. Cultures on all media are broadly similar, but growth is less luxuriant on Czapek.

Microscopic Characters:

The primary mycelium is distinguished from all other species in that the septae in the marginal hyphae are usually accompanied by a conic or globose swelling in the mycelium just below (Fig. II: 4). This feature appears to be constant for the majority of the strains studied. The maximum diameter of the hyphae of the marginal hyphae is $2{\cdot}2\mu$.

The secondary mycelium consists of long stout darkly coloured hyphae $1{\cdot}4$—$10{\cdot}6\mu$ diam. which are loosely interlocked to closely anastomosed (Fig. II: 8). They appear when the colony is older than 5 days, and run under the surface of the primary mycelium.

Conidiophores and conidia (Fig. II: 11):

These comprise an indefinitely branched system whose units measure 150—650μ × 1·5—3μ. The conidiophores are not really distinct from the vegetative mycelium. Each unit consists of a main axis, sometimes weakly differentiated, which is divided dichotomously to the second degree over at least half of its axis. The ultimate fertile branches are 4·5—155 × 1·7—2·5μ, and are normally 1—3 septate, and smooth or irregular in outline. The conidia are usually scattered down their length but may be in groups of 2 or 3. There is no recognizable fertile region on the ultimate hyphae and the conidia apparently develop at random. The conidia are sessile, oval to subglobose, equilateral and rounded at both ends or sometimes bluntly pointed distally or with truncate bases, hyaline and colourless individually but collectively white, fawn coloured or very pale grey; 1·8—3·4 × 2·9—6·9μ, ave. 2·7 × 4·5μ.

16. *Hypoxylon pynaerthii* Bres.

Bresadola, G. Ann. Mycol. **9**, 275, (1911), Miller, J. H. World Species of *Hypoxylon*, 82, (1961).

Stromata usually indefinitely effused but sometimes aplanopulvinate, 1·5—16 × 2·3—35 × 0·5—0·8 mm.; always partly embedded in the substrate though not necessarily erumpent through bark; surface characteristically dull brown to black and coarsely grained and often granulate or warty, never shiny (Plate II: 4). Entostroma mostly carbonous, forming bands between the perithecia; basal tissue slight in quantity. Perithecia variable in shape depending on their distance apart, ovoid or conic due to mutual pressure, 200—400 × 400—600μ; ostioles indistinct papillate and not raised above the stromal level. Asci clavate or cylindric, 130—180 × 8—11μ, stipes 51—85μ. Spores broadly oval, equilateral with ends blunt pointed, in varying shades of brown, 5·0—9·0 × 13·5—19·0μ, ave. 6·7 × 15·5μ.

Hosts: *Olea capensis* and wood unidentified.

Material examined: Martin 46; Nature's Valley, Knysna District, Western Cape, South Africa, (1958). Martin 218; Hogsback nr. Alice, Eastern Cape, South Africa, (1958).

Cultural Characters (Plate IV: 7):

Germination pattern free spreading. Colonies velvet felty, similar to *H. albocinctum* but less luxuriant and more closely appressed uniformly opaque white. Margin not clearly distinct, canescent to velvety, entire, with compact peripheral hyphae. Conidia produced after 8 months in bottle culture but not on plates, pale fawn-grey in colour. Stain nil. Carbonization of the mycelium occurs to a variable extent, starting at and extending from the centre of the colony outwards. Growth at 25°C moderate, 3·2 mm./day. Czapek bottle cultures, though less luxuriant at first, eventually guttate golden brown droplets and develop stain of the same colour.

Microscopic Characters:

These are very similar to those of *H. albocinctum.*

Marginal hyphae have a maximum diameter of 2·0μ. The secondary mycelium is densely branched and closely anastomosed, 1·4—3·0μ in diameter.

Conidiophores and conidia (Fig. II: 12).

These are also of the same general type as *H. albocinctum,* but may be distinguished by the tendency of the conidia to arise in groups of 2 or 3 as well as singly, and by their larger average size. The conidiophores measure 400—500μ ×3—4μ branched dichotomously to the second degree over the length of the primary axis. The fertile branches are 88—106×1·9—3·0μ, irregular in outline. The conidia are sessile, elliptic, equilateral with bluntly pointed or rounded ends, wide based, grey or fawn collectively 1·7—3·4×4·0—7·4μ, ave. 2·8×5·2μ.

17. **Hypoxylon adumbratio** Martin nov. sp.

Stromata usually multiperitheciate and aplanate-effuse, but sometimes pulvinate when containing one or a few perithecia, 4·2—96×6·0—153×0·9—2·5 mm. (Plate I: 8). Surface of the stroma shiny black, and smooth or uneven depending on the degree of immersion of the perithecia within. Perithecia relatively large, 750—1200×700—2000μ, ostioles papillate, usually tapering and spout shaped, often encircled superficially by one or more ridges in the stromal surface that resemble the truncate discs of those species in the section Annulata (*H. stygium, H. truncatum* etc.). Asci cylindric, long stipitate, 180—250×5·7μ, stipes 100—170μ. Spores oval, inequilateral, navicular with one side straight and the other concave; dark chocolate brown; 3·5—7·0×11·0—16·0μ, ave. 5·3×13·1μ.

Host: Olea capensis.
Material examined: Martin 91, 154, 288, 393, 451, 465, 496, 554; Nature's Valley, Knysna District, Western Cape, South Africa, (1959, 1958).

Cultural Characters (Plate IV: 6):

Germination pattern free spreading. Colonies velvet lanose, with aerial mycelium 2—3 mm. high, gleaming opaque white and smooth, growth normally uniform except in some cases where a "halo" effect arises due to the rise in height of the mycelium from the centre towards the margin. Margin indistinct, or forming a zone 3—5 mm. broad, submersed to canescent, or forming a ruff of velvet silky hyphae, entire or very slightly segmented; peripheral hyphae compact and lying parallel. Conidia developing late, and never profusely, fawn brown in colour. Stain variable, absent in plate culture, but developing in bottle cultures after 14—18 days, light brown, chocolate, or light purple; diffuse throughout the colony. Bottle cultures 8 months old also developed carbonization of the medium as a black layer 0·3 mm. deep. Growth at 25°C very slow, 1·49 mm./day. Cultures on maize and Czapek are less luxuriant than on malt.

Microscopic Characters:

Primary mycelium not diagnostic; maximum diameter of marginal hyphae $= 2 \cdot 2\mu$. Secondary mycelium crustose, composed of very short densely branched and closely anastomosed hyphae, $1 \cdot 7$—$4 \cdot 2\mu$ diam. (Fig. II: 7).

Conidiophores and conidia (Fig. II: 13):

These comprise an indefinitely dichotomously branched system 500—1000μ long, whose ultimate fertile branches bear small clusters of sessile pleurocrogenous conidia. This is a good example of *Nodulisporium* type IIa as defined previously (Martin, 1967).

The main axes, about $2 \cdot 5\mu$ in diameter, are strongly monopodial and clearly distinct, since they bear relatively short lateral fertile branches off the distal segments. The fertile branches are 11—$57 \times 2 \cdot 0$—$2 \cdot 7\mu$, and are regularly geniculate towards the apices. The conidia are acropleurogenous, elongate elliptic or pyriform, normally with the distal end acute and the other rounded, $2 \cdot 0$—$3 \cdot 4 \times 5 \cdot 1$—$12 \cdot 5\mu$ ave. $2 \cdot 7 \times 7 \cdot 4\mu$. The elongate shape of the conidia is unusual, only being matched by that of *H. mammatum*.

Foreign Species with Imperfect Stages.

18. **Hypoxylon aquilum** (Fr.) Martin comb. nov.
Berlése, A. N. & G. Bresadola Ann. Sco. Alp. Trid. **14**, 18, (1887—1888), Bizzozero, G. Flora Ven. critt. **I,** 191, (1885), Brooks, F. T. Plant Diseases, 198, (1953), Dennis, R. W. G. British Cup Fungi, 181, (1960), De Notaris, G. Giorn. Bot. Ital. **1,** 322—325, (1844), De Notaris, G. Sferiacei Italici 21, (1863), Ellis, J. B. & B. M. Everhart N. Amer. Pyren. 163, (1892), Fabré, J. H. Ann. Sci. Nat. **VI, 9,** 78, (1879), Fuckel, L. Symbolae Mycologicae 148, (1869—1870), Hennings, P. Bot. Ver. Prov. Brand. **40,** 155, (1898), Lambotte, E. Flora myc. belge **II,** 292, (1880), Miller, J. H. Mycologia **20,** 191, (1928), Miller, J. H. Bothalia IV, 257, (1942), Rabenhorst, G. L. Deutsch Krypt. Flor. I, 187, (1844—1848), Rabenhorst, G. L. Kryptflor. Deutsch II, 224, (1887), Rehm, H. Berichte Natur. ver Augs. **26,** 129, (1881), Rehm, H. Ascomycetes Lojkani Hungaria, 27, (1882), Rehm, H. Hedwigia **21,** 131, (1882), Rick, J. Broteria ser. science. nat. **1,** 184, (1932), Saccardo, P.A. Fungi Ital. 586, (1886—1887), Shear, C. L. Mycologia **33,** 324, (1941),

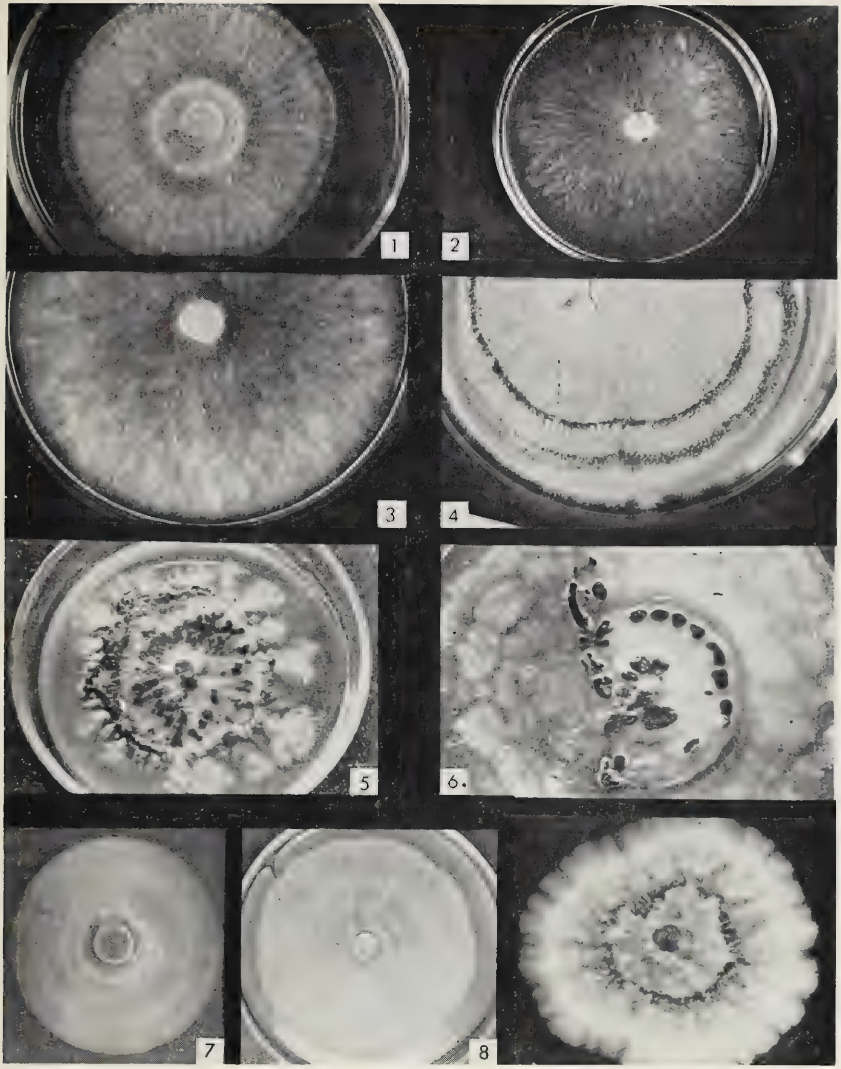


PLATE III. Culture morphology. All on malt agar at 25°C and 14 days old unless otherwise stated.

1. *Hypoxylon perusensis.*
2. *Hypoxylon ravenelii.*
3. *Hypoxylon corticium* (*H. aridicolum* similar).
4. *Hypoxylon serpens.*
5. *Hypoxylon thelenum* (*H. aquilum* and *H. necatrix* similar).
6. *Hypoxylon diathrauston.*
7. *Hypoxylon regale.*
8. *Hypoxylon cuneosporum.*
9. *Hypoxylon entoleucum*, showing black sclerotia near centre.

Theissen, F. Beih, Bot. Cent. **27,** 393, (1910), Wallroth, K. F. W. in Bluff & Fingerhuth: Comp. Flor. Germ. **II,** 835, (1833), Winter, G. Hedwigia **24,** 100, (1885).

sub *Rosellinia byssiseda* Tode. Schröter, T. Kryptflora Schles. **299**, (1908), Traverso, J. B. Flor. Ital. Crypt. **1,** 456, (1906).

sub *Sphaeria aquila* Fries. Berkeley, M. J. in Smith, J. E. English Flora **5,** (2) **259**, (1836), Berkeley, M. J. Mag. Zool. & Bot. **6,** 361, (1841), Cooke, M. C. Ann. NY. Acad. Sci. **1,** 186, (1878), Cooke, M. C. & J. B. Ellis Grevillea **5,** 50, (1876), Fries, E. M. Systema Mycologicum 442, (1823), Fries, E. M. Syn, Scler. Suecia 37, (1823), Kickx, J. Flor. crypt. Flandres 329, (1967).

Stromata ovoid or globose, 1·2—1·8 × 1·2—1·8 × 1·1—1·9 mm. normally uniperitheciate, and usually closely aggregated, dull brown to black in colour. Subiculum of dark reticulate hyphae normally present. Outer entostroma hard, black carbonous; basal tissue variable in extent, corky and dull brown at maturity. Perithecia large, oval, 900—1200 × 1000—1100μ, ostioles prominent papillate. Asci cylindric, short stipitate, 160—200 × 7·11μ; stipes 50—120μ; ascal plugs constricted. Spores elongate, elliptic or navicular, inequilateral with one side flat or gibbous, dark brown, bearing a short obtuse appendage at both ends, 7·0—100·0 × 17·5—22·5, ave. 8·1 × 20·4μ.; germ slit on convex side of the spore. This species is close to *H. corticium*, differing mainly in the appendiculate spores.

Material examined: A large quantity of material in the Rijks Herbarium. Martin 1758; ex Carroll, San Cristobal, Chiapas, Mexico (1963). Martin 1797, 1799; ex Carroll, Elsehored & Sterns Klinten, Denmark (1963).

Cultural Characters:

Germination pattern free spreading. Colonies silky, fine in texture, uniform, dull white; margin not distinct, appressed, entire with peripheral hyphae lying together. Stain absent; carbonization usually present in oval or fleck-shaped areas, giving a characteristic mottled effect, and serving to distinguish the species from *H. corticium*. Growth at 25°C moderate to fast, 3·30—7·70 mm./day.

Microscopic Characters:

Primary mycelium not diagnostic; maximum diameter of the marginal mycelium = 2·8μ. Secondary mycelium well developed, uniform, ropy or reticulate, dark brown with hyphae 2·8—4·3μ in diameter.

Imperfect stage (Fig. III: 3):

Brefeld, O. Untersuchungen aus dem gesammtgebiete der Mykologie **X**, Ascomyceten 2, 258, 1891. Cooke, M. C. Handbook of British Fungi **II**, 853, 1871. Kirschstein, W. Trans. Brit. Mycol. Soc. **18,** 303, 1934. Miller, J. H. Mycologia **20,** 326, 1928. Ramsey, C. B. Proc. Indiana Acad. Sci. **1914,** 254,

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258, 1914. Saccardo, P. A. Atti. Soc. Ven. Trent. Sci. Nat. **II**, 108, 1873, sub *Sporotrichum fuscum*.

The conidiophores lack pigmentation but are distinguishable from the vegetative mycelium by determinate growth. They measure 225—570 × 3—4μ, arise from the upper segments of the primary axes and are dichotomously branched to the second degree. The fertile branches are variable in length, 8·75 × 2·5—3·8μ and are slightly swollen or produced into a distinct globose head. The conidia are acropleurogenous, sessile on small geniculate protuberances, not arranged in any definite order, oval to botuliform with wide truncate or narrow or convex bases, greenish-grey collectively, 2·5—3·1 × 3·7—6·8μ, ave. 3·0 × 5·0μ.

19. **Hypoxylon thelenum** (Fr.) Martin.

sub *Byssosphaeria thelena* (Fr.) Cke. Cooke, M. C. Grevillea **15**, 81, (1887)-

sub *Rosellinia thelena* (Fr.) Rab. Bizzozero, G. Flora Ven, critt. **1**, 191 (1885), Bresadola, G. & P. A. Saccardo Malphighia **13**, 437, (1899), Cesati, V. Hedwigia **14**, 14, (1875), Ellis, J. B. Proc. Acad. Nat. Sci. Philad. **III, 25**, 22, (1895), Ellis, J. B. & B. M. Everhart N. Amer. Pyren. 166, (1892), Hennings, P. et al. Ascomycetes, in Krypt. Flora der Mark Brand **VII**, 212, (1905), Karsten, P. A. Mycologia fennica **II**. Pyrenomycetes, 45, (1873), Lambotte, E. Flora myc. belge 293, (1880), Rabenhorst, G. L. Deutsch Kryptflora **I**, 187, 1844, (1848), Rabenhorst, G. L. Kryptflor. Deutch **II**, 226, (1887), Rick, J. Broteria ser. cienc. nat. **1**, 190, (1932), Saccardo, P. A. Nuovo Giorn. Bot. Ital. **7**, 328, (1875), Saccardo, P. A. Fungi Ital. 587, (1877—1886), Saccardo, P. A. Sylloge Fungorum I, 352, (1882), Schröter, T. in Cohn: Kryptflor. von Schlesien 229, (1908), Traverso, J. B. Flor. Ital. Crypt. **1**, 456, (1906).

sub *Sphaeria thelena* Fr. Cooke, M. C. Handbook of British Fungi **II**, 835, (1871), Fries, E. M. Syn. Scler. Suec. 36, (1823), Kickx, J. Flore crypt. Flandres 329, (1867).

Stromata ovoid, sometimes with conical vertices, 0·9 × 3·5 × 0·9—8 mm. × 0·8—1·0; usually gregarious and embedded in a subiculum of dense matted hyphae with ropy anastomoses; surface dull murky brown to black, basal tissue slight or vestigial, dull brown. Perithecia one to several per stroma, evident only at vertices or evident to the bases, globose with conical vertices, 700—1300μ; ostioles prominent papillate. Asci cylindric, short stipitate, 220—260 × 10—11μ, stipes 60—70μ; Ascal plugs constricted. Spores inequilateral with one end gibbous or straight, dark brown with long acicular tails on both ends, 5·0—11·5 × 15·5—31·0, ave. 8·0 × 23·9μ. Germ slit on convex side of the spore.

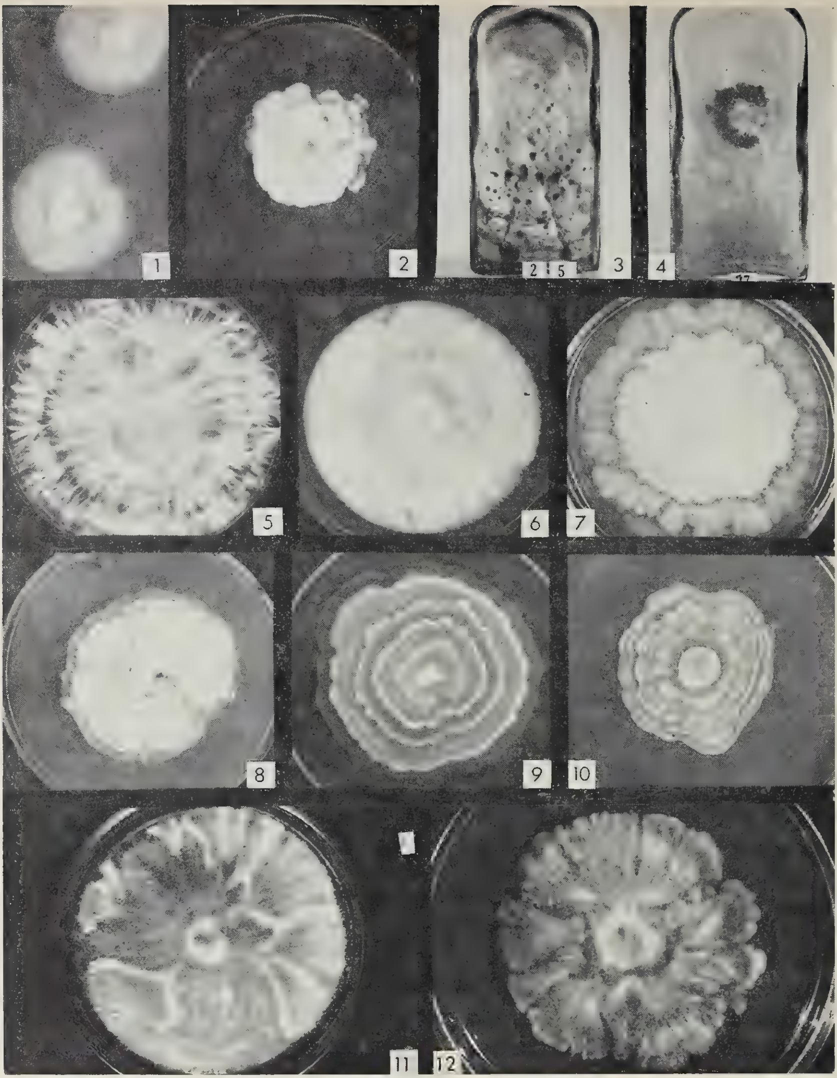

PLATE IV. Culture Morphology contd.

1. *Hypoxylon minutissimum:* Young culture 7 days old on maize, showing fine velvet surface.
2. *Hypoxylon mastoideum:* Young culture 10 days old on malt, showing lanose centre (*H. chrysoconium* similar).
3. *Hypoxylon minutissimum:* Czapek bottle culture 1 month old, showing exudation.
4. *Hypoxylon mastoideum:* Maize bottle culture 1 month old, showing conidial development around incculum.
5. *Hypoxylon mastoideum:* Malt plate culture 1 month old, showing plumose development.
6. *Hypoxylon adumbratio.*
7. *Hypoxylon pynaerthii.*
8. *Hypoxylon albocinctum* on Leonian's agar showing extreme zonation.
9. *Hypoxylon smilacicolum* on Leonian's agar.
10. *Hypoxylon sassafras.*
11. *Hypoxylon albocinctum;* non-zonate strain.
12. *Hypoxylon discolor.*

Material examined:

Bas 1437C; on *Betula*, Bergen, (1958), (R).
Broome in Rabenhorst's Fungi europaei 1536; on *Pinus*, Batheaston, Bath. England (R).
Desmazières 271; North France, (R).
Geesteranus 3426; on *Picea*, Baxterl-Best, Veldeisbos, Holland, (1946), (R).
Jack in Rabenhorst's Fungi europaei 757; Salemi, Italy, (R).
Martin 1798; ex Carroll 453, Hareskov, Copenhagen, (1963).
Rick; S. Leopoldo, Rio Grande do Sul, Brazil, (1908), (R).
Saccardo; Mycotheca italica 627, on *Abies excelsa*, Padua, Italy, (1900), (R).
Mycotheca italica 1028, on *Abies*, Bosco, Belluno, Italy, (1902), (R).
Scharvo & Schnall; on *Quercus*, München, Hartmannshofen, Germany, (1891), (R).
Splitgerber; on *Fagus*, (R).

Cultural Characters (Plate III: 5):

Germination pattern free spreading. Colonies canescent, appressed, uniform, dull white; margin segmented but not clearly distinct, with peripheral hyphae lying close together. Stain none; carbonization slight, in fleck formation. Growth at 25°C fast, 4·00 mm./day.

Microscopic Characters:

Primary mycelium undiagnostic; maximum diameter of the marginal hyphae 1·8μ. Secondary mycelium loose in construction, uniform, 4·3—7·8μ diam. Conidiophores and conidia: None observed.

This species is hard to distinguish from *H. aquilum* in culture.

20. **Hypoxylon necatrix** (Hartig) Martin comb. nov.

sub *Rosellinia necatrix* (Hartig) Berl: Brooks, F. T. Plant Diseases, 197, (1953), Cooley, J. S. Bot. Rev. **12,** 88, (1946), Hartig, R. Textbook of the diseases of trees, 82, (1894), Matz, J. Puerto Rico Dept. Agr. y Trabajo Circ. **32,** 1—20, (1920), Raabe, R. D. & G. A. Zentmeyer Calif. Avoc. Soc. Yearbook **39,** 182—174, (1955), Saccardo, P. A. Sylloge Fungorum **XVII**, 595, (1905), Stevens, F. L. The Fungi which Cause Plant Disease, 232, (1919).

Stromata uniperitheciate, glomerular, dull black, 1·5—1·6 mm. in diameter, embedded in dense brown ropy subiculum. Perithecia globose, large 1200—1400μ diam.; ostioles papillate but not conspicuous. Asci not seen. Spores elongate elliptic, inequilateral, flat to concave sided, with ends produced:—sometimes acuminate, 5·7—8·7 × 32·0—47·0μ, ave. 6·8 × 38·2μ.

Material examined: Martin 895; ex Centraalbureau voor Schimmelcultures, Baarn, Holland, (1961), (Culture only). Thomas; on *Pyrus malus*, Watsonville, California, U.S.A., (1933) (NYBG),

Cultural Characters:

Germination pattern free spreading. Colonies silky, growing freely with a fine texture, uniform, pure white. Margin entire, not distinct, with peripheral hyphae widely dispersed. Stain none, carbonization slight, in fleck formation. Growth at 25°C fast, 4·00 mm./day.

Microscopic Characters:

Primary mycelium with subseptate bulbous swellings; marginal hyphae with a maximum diameter of 2·0μ. Secondary mycelium not observed.
Imperfect stage (Fig. III: 1):

sub *Dematophora necatrix* (Hart) Berl.
Behrens, J. Centralblatt für Bakteriologie **II, 3,** 584—589, 639—645, 743—750, (1897), Berlése, A. N. Rivista di Patologia vegetale **1,** 5—17, 33—46, (1892), Hansen, H. N., Thomas H. E. & H. Earl Thomas; Hilgardia **10,** 561—565, (1937), Hartig, R. Untersuch Forstbot. Inst. Münch. **3,** 95—140, (1883), Hartig, R. Textbook of the diseases of trees, 82, (1894), Prillieux, M. Bull. Soc. Mycol. de France **20,** 30—38, (1904), Rant, A. Bull. Jard. Bot. Buitenzorg **2,** 1—22, (1916), Stevens, F. L. Plant Disease Fungi, 163, (1925), Viala, P. Monographie du pourridié des vignes et des arbres fruitiers. Montpellier, (1891).

sub *Graphium necatrix* (Hart.) Trav. Brooks, F. T. Plant Diseases, 197, (1953), Marchionatto, J. B. Rev. Arg. Agron. **3,** 153—158, (1936), Traverso, J. B. Flora Ital. Crypt. **1,** 454, (1906).

Conidiophores are produced on dull brown ropy coremia of the *Graphium* type. Coremia are produced both in association with the stromata and on the colonies with extreme age, project straight outwards, and measure 800—1800 × 18—56μ. The conidiophores are not distinctly recognizable since their stalks below the fertile region are tightly coiled and are also indistinguishable from the supporting mycelium of the coremium. They are branched dichotomously to the second degree so that the apex of the coremium resembles a small brush; the fertile branches are 18—48 × 2·7—3·6μ and bear the conidia pleurogenously off geniculate protrusions. The conidia are sessile, elongate elliptic to narrow cylindric, with truncate bases, dull white *en masse*, 1·8—2·8 × 4·7—8·1μ, ave. 2·2 × 5·7μ.

21. *Hypoxylon diathrauston* Rehm. Miller, J. H. World Species of Hypoxylon, 60, (1961), Rabenhorst, L. Kryptflora Deutsch **II**, 857, (1887), Rehm, H.

Berichte Naturh, Ver. Augs. **26,** 69, (1881), Rehm, H. Hedwigia **21,** 48, (1882).

Stromata globose to pulvinate, 0·6—4·0 × 0·6—5·0 × 0·7—1·2 mm. forming small irregular patches of indefinite extent. No subiculum. Ectostroma dull brown, persistent up to maturity as a veneer then wearing off to expose the black carbonous entostroma; basal tissue slight, corky, dull white. Perithecia 1—4 per stroma, evident to base or only at the vertices, globose with conic upper halves, 600—700 × 700—800μ diam.; ostioles prominently papillate. Asci cylindric, short stipitate, 140—260 × 7—8μ, stipes 23—78μ; ascal plugs constricted. Spores elongate navicular with one side flat, with broad obtuse appendages on each end, dark brown, 5·5—13·5 × 18·5—36·5μ, ave. 10·2 × 25·3μ. germ slit on convex side of the spore.

Material examined: Cooke 255; on *Abies concolor*, Sisson Southern Trail, Mt. Shasta, California, U.S.A., (1947), (AA). Martin 1566; San Blás, Nayarit, Mexico, (1962). Rehm 274; on *Pinus mughus*, Kuhtei, Tyrol, Italy, (1874), (NYBG). Seaver & Bethel; Tolland, Colorado, U.S.A., (1910), (NYBG). Seaver & Shope 32; on *Abies lasiocarpa*, Middle Boulder Canyon, Colorado, U.S.A., (1929) (NYBG), sub *Creosphaeria pinea* Petrak.

Cultural Characters (Plate III: 6):

Germination pattern free spreading. Colonies canescent, appressed and sodden, strongly zonate, dull white or colourless. Margin not distinct, entire, peripheral hyphae lying together. Stain absent. Carbonization extensive, in fleck formation. Growth at 25°C slow, 2·0 mm./day.

Microscopic Characters:

Primary mycelium not diagnostic; maximum diameter of marginal hyphae = 2·5μ. Secondary mycelium with irregular globose swellings, closely anastomosed, 2·5—5·0μ diam.

Conidiophores and conidia (Fig. III: 2):

Conidiophores are produced on dull brown ropy pulvinate coremia of the *Graphium* type that are only known at present from culture. The coremia measure 450—500 wide × 350—600μ high. The conidiophores are not clearly distinguishable, comprising indefinitely branched systems 450—600μ long, though the branches are restricted to the upper portion of the main axes, which are about 3μ in diameter. The branching is characteristically ternate, and the fertile branches measure 15—50 × 1·8—2·5μ with conidia emerging pleurogenously from geniculate protrusions. The conidia are sessile, clavate, with truncate bases, fawn-brown *en masse*, 1·6—1·8 × 3·7—5·0μ, ave. 1·7 × 4·3μ.

22. **Hypoxylon glandiformis** (E. & E.) Martin, nov. comb.

sub *Rosellinia glandiformis* E. & E. Ellis, J. B. & B. M. Everhart. Proc. Nat. Sci. Philad. **III**, **20**, 227, (1890), Ellis, J. B. & B. M. Everhart. North Amer. Pyren. 170, (1892), Ramsey, G. B. Proc. Indiana Acad. Sci. **1914**, 255, (1914).

Stromata globose to pulvinate, 0·5—1·8×0·5—15·0×0·4—0·7 mm., dull black. Subiculum absent. Basal tissue slight, dull black. Perithecia 1—30 per stroma, evident to the bases to partially or vaguely evident, globose, 400—500 ×500—600μ diam; ostioles indistinctly papillate, minute and inconspicuous. Asci cylindric, reported by Ellis & Everhart as 100—114×8—10μ. Spores elliptic, equilateral or inequilateral with one side gibbous, pale brown with prominent hyaline sheaths, 5·0—12·5×13·0—22·5μ, ave. 8·0×16·9μ.

Material examined:

sub *Hypoxylon glandiformis.* Martin 1160; Lake Ozark, Mo. U.S.A., (1962).

sub *Rosellinia glandiformis.* Ellis; on *Rhus venenata*, Newfield, N.J., U.S.A.. (1890), (NYBG). Langlois 1768; on *Quercus*, St. Martinsville, Louisiana, U.S.A., (1889), (NYBG). Shear; Monroe, La., U.S.A., (NFC). Zabriskie 262; Long Island, N.Y. State, U.S.A. (1889) (NYBG).

Cultural Characters:

Germination pattern radiate. Colonies canescent, appressed uniform with colourless sterile mycelium, covered over profusely by grey conidia. Margin entire, not distinct; peripheral hyphae lying together. Stain and carbonization absent. Growth at 25°C slow, 1·00 mm./day.

Microscopic Characters:

Primary mycelium undiagnostic; maximum diameter of the marginal hyphae = 0·9μ. Secondary mycelium absent.

Conidiophores and conidia (Fig. III: 4):

Conidiophores comprising large units 500—600μ long, dichotomously or ternately branched to the second degree with the primary axes 2—3μ diameter, bearing subordinates over their entire length. Fertile branches relatively short, 15—60×2·2—3·1μ, with the distal parts regularly geniculate; borne at varying angles to the supporting axis or in a more regular trident formation. Conidia sessile, broad oval with wide truncate bases, cineraceous grey *en masse*, 2·2—2·5×2·7—3·1μ, ave. 2·3×3·0μ.

23. **Hypoxylon ludovicianum** Ellis & Everhart ex Martin, nov. sp.

Stromata pulvinate to aplanopulvinate, 0·4—5·5×0·4—17×0·7—1·2 mms., dull black at maturity. Basal tissue slight, dull brown to black. Perithecia one to several per stroma, evident entirely or only to the vertices, hemispheric, 400—1100×400—900μ; ostioles medium papillate or minute and very hard to see. Asci not seen. Spores oval elliptic, inequilateral with one side gibbous or straight, pale to medium brown, 4·5—7·0×10·0—16·5μ, ave. 5·8×12·3μ.

Ellis notes on the packet in his herbarium that this species is possibly not distinct from *Rossellinia subiculata* (*H. chrysoconium*). On superficial examination the main difference appears to lie in the absence of subiculum in this species.

Material examined:

sub *Hypoxylon ludovicianum*. Martin 1718; Savoy State Forest, Mass., U.S.A., (1963). Martin 1820; ex Rogerson, Ulster Co., N.Y. State, U.S.A., (1963).

sub *Rosellinia ludoviciana* Ellis and Everhart, ined? Kramer in Kansas S.C. Herb. 13; Leavenworth, Kansas, U.S.A., (NYBG), (1958). Langlois; Flora ludoviciana 299 in Ellis Herb., on *Salix*, Point à la Hache, La., U.S.A., (1886), (NYBG).

Cultural Characters:

Germination pattern radiate. Colonies felty to velvety, sometimes somewhat gelatinous, growing freely with a fine texture, dull or pure white. Margin distinct, entire, with peripheral hyphae compact. Stain absent or olivaceous green; carbonization always absent. Conidia appear immediately or at least by 7 days, so that the colony turns pale grey. This is in contrast to *H. chrysoconium* where the conidia develop later and are not as conspicuous.

Microscopic Characters:

Primary mycelium undiagnostic; marginal hyphae with a maximum diameter of 1·8μ. Secondary mycelium with subseptate swellings, variable in occurrence, and arranged loosely with hyphae 2·2—3·0μ in diameter.

Conidiophores and conidia (Fig. III: 5):

Conidiophores not clearly distinct, dichotomously or ternately branched over most or all of the primary axes to the first or second degree, 370—600×1·5—3·7μ. Fertile branches variable in length, 27—122×1·5—3·1μ, conspicuously warted, always geniculate, and lying at a variable angle to the supporting axes. Conidia pleuracrogenous, sessile, subglobose to oval, broad or narrow based, pale grey, 1·8—3·1×2·5—5·0μ, ave. 2·6×4·0μ.

24. *Hypoxylon chrysoconium* B. & Br.

Berkeley, M. J. & C. E. Broome Jour. Linn. Soc. **14,** 120, (1875), Miller, J. H. World Species of *Hypoxylon* 54, (1961), Petch, T. Ann. Roy. Bot Gard. **8,** 160, (1924).

sub *Rosellinia subiculata* (Schw.) Sacc. Ferdinandsen, C. & O. Winge Bot.

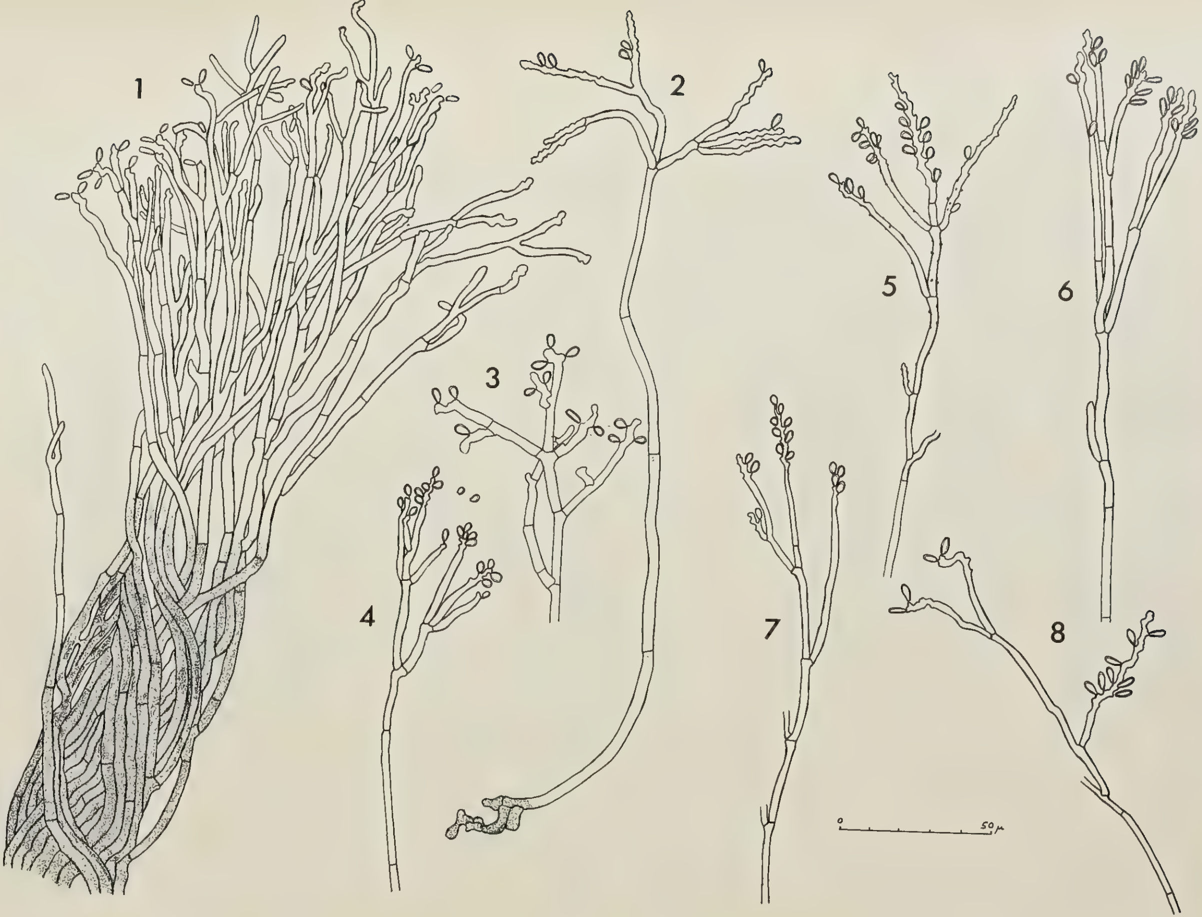

FIG. III. Conidiophores and Conidia. *Nodulisporium* type II.

1. *Hypoxylon necatrix: Graphium*-type coremium.
2. *Hypoxylon diathrauston:* Whole conidiophore for comparison, showing basal attach-

5. *Hypoxylon ludoviciamum.*
6. *Hypoxylon illitum.*

Tidskrif, **29,** 17, (1909), Miller, J. H. Mycologia **20,** 327, (1928), Nowell, W. West Indian Bull. **16,** 48, (1916), Parks, H. E. Univ. Calif. Publ. Bot. **12,** 51, (1926), Ramsey, C. B. Proc. Indiana Acad Sci. **1914,** 256, (1914), Rehm, H. Hedwigia **21,** 132, (1882), Rick, J. Broteria ser. cienc. nat. **1,** 187, (1932), Theissen, F. Beih. Bot. Cent. 27, 394, (1910), Weir, J. R. U.S.D.A. Bull. **1380**, 92, (1916).

sub *Sphaeria subiculata* Schw. Schweinitz, L. v.d. Synops. Fung. Carol. Sup. 44, (1822).

Stromata globose, pulvinate or aplanopulvinate depending on the number of perithecia per stroma, 0·6—8 × 0·6 × 0·4—1·1 mm., deep black at maturity (Plate I: 2). Subiculum crustose, densely branched, closely anastomosed but not sheathing the stromata, bright yellow to orange. Initial layer (ectostroma) white or fawn-brown, persistent though merging with carbonous layer of the entostroma. Basal tissue slight, dull brown to black. Perithecia one to several per stroma, usually evident to the bases though sometimes coalesced to the vertices, globose or hemispheric, 500—800 × 500—900μ; ostioles medium papillate. Asci cylindric, short stipitate, 90—200 × 7—12μ, stipes 30—114μ. Spores oval elliptic, inequilateral with one side gibbous, dark brown, 4·5—7·0 × 7·5—14·5μ, ave. 5·8 × 11·1μ.

Material examined: Doty 11279, 11393: Raroia Atoll, Tuamotu Archipelago, (1952), (NYBG). Martin 1624, 1623; Nyack, N.Y. State, U.S.A., (1963). Martin 1650, 1651, 1652; Roxbury, Conn., U.S.A., (1963). Martin 1718; Savoy State Forest, Mass., U.S.A., (1963). Rogers 3128; on *Bambusa*, Lauai, Hawaii, (1947), (NYBG).

Cultural Characters:

Germination pattern radiate. Colonies velvet felty, growing freely with a fine texture, uniform to strongly zonate, pure white, often gleaming, sometimes discoloured ochre. Margin usually not distinct, lobed or entire, with peripheral hyphae lying close together. Stain and carbonization absent. Growth at 25°C very slow, 0·56—1·60 mm./day.

Microscopic Characters:

Primary mycelium undiagnostic; marginal hyphae have a maximum diameter of 1·8μ. Secondary mycelium absent.

Conidiophores and conidia (Fig. III: 7):

Conidiophores not clearly distinct from the vegetative mycelium, dichotomously or ternately branched to the second degree or indefinitely over most or all of the primary axes, 180—600 × 1·5—2·2μ. Fertile branches variable in length, 19—112 × 1·2—2·2μ, lying at a variable angle to the supporting axes or in trident formation, with the conidial portion smooth, irregular or geniculate in outline. Conidia pleuracrogenous in small groups, sessile, subglobose, with wide truncate bases, white *en masse*, 1·2—2·5 × 2·2—3·7μ, ave. 1·9 × 2·8μ.

25. *Hypoxylon illitum* (Schw.) Curt.

Curtis, M. A. Geol. and Nat. Hist. Survey of N.C., **III** 140, (1867), Ellis, J. B. & B. M. Everhart Jour. Myc. **4,** 109, (1887), North Amer. Pyren., 654, (1892), Miller, J. H. World Species of *Hypoxylon* 83, (1961), Shear, C. L. Lloydia **10,** 63, (1947).

sub *Sphaeria illita* Schw. Schweinitz, L. v.d. Trans. Amer. Phil. Soc. Philad., N.S. **4,** 192, (1832).

Stromata globose, pulvinate or aplanopulvinate, depending on the number of perithecia, 1·1—19 × 1·1—33 × 0·9—1·8 mm. dull black. Ectostroma continuous or disappearing abruptly over the ostioles to leave small annulate discs 0·5 mm. in diameter, and thereby exposing the carbonous outer entostroma. Basal tissue slight, dull black. Perithecia one to several per stroma, evident to the bases, partially evident, or completely immersed, globose to broad ovate, 700—1000 × 800—1000μ; ostioles prominent papillate, frequently beak-shaped. Asci cylindric, inequilateral, crescentic or with one side flat, amber to pale brown, 3·0—4·5 × 10·0—12·5μ, ave. 3·8 × 11·3μ. This species like *H. albocinctum* and *H. cuneosporum*, is easy to confuse with *H. serpens*. The main differentiating character is the nature of the spores.

Material examined: Demetrio 56; on *Ulmus americana*, Mo., U.S.A., (1887), (NYBG). Martin 1127, 1129, 1130, 1131; Lake Ozark, Mo., U.S.A., (1962). Miller; on *Platanus occidentalis*, Princeton, Ga., U.S.A., (1928), (AA).

Cultural Characters:

Germination pattern free spreading. Colonies velvet felty, growing free with a fine texture, strongly zonate, pure white. Margin not distinct, lobed, with the peripheral hyphae lying together. Stain none, carbonization none. Growth at 25°C very slow, 1·20 mm./day.

Microscopic Characters (Fig. III: 6).

Primary mycelium undiagnostic. Marginal hyphae have a maximum diameter of 2·3μ. Secondary mycelium loosely organised, uniform, 1·5—2·5μ diam.

Conidiophores and conidia:

Conidiophores distinct, branched dichotomously or ternately to the first or second degree near the apex of the primary axes, 110—170 × 3μ. Fertile branches 20—78 × 1·5—2·3μ, not noticeably geniculate though irregular in outline, and lying free from the supporting axes. Conidia pleuracrogenous, sessile, cylindric or clavate with wide truncate bases, white *en masse*, 2·5—3·2×6·1—8·9μ, ave. 3·3×7·3μ.

26. *Hypoxylon mammatum* (Wahl) Miller.
Miller, J. H. World Species of *Hypoxylon* 64, (1961).
sub *Entoleuca callimorpha* Syd. Sydow, H. & F. Petrak. Annales Mycologici **20,** 186, (1922).
sub *Hypoxylon blakei* Berk & Curt. Berkeley, M. J. Grevillea **4,** 52, (1875).
sub *Hypoxylon holwayi* Ellis. Cooke, M. C. Grevillea **11,** 130, (1883), Ellis, J. B. Amer. Nat. **17,** 193, (1883), Ellis, J. H. & B. M. Everhart. Jour. Mycol. **4,** 67, (1888).
sub *Hypoxylon morsei* Berk & Curt. Berkeley M. J. Grevillea **4,** 51, 1875. Lloyd C. G. Myc. Writ. **7,** 1314, (1924), Lloyd C. G. Ibid. **7,** (1354), Miller, J. H. Mycologia **20,** 320, (1928), Traverso, J. B. Flora Ital. Crypt. **1,** 47, (1906).
sub *Hypoxylon pauperatum* Karsten. Bresadola, G. & P. A. Saccardo. Malphighia **II,** 294, (1897), Karsten, P. A. Mycologia fennica **II.** Pyrenomycetes 42, (1873). Rehm, H. Ann. Mycol. **II.** 395, (1913).
sub *Hypoxylon pruinatum* (Klotze) Cke. Cooke, M. C. Grevillea **II,** 130, 1883. Currey, F. Trans. Linn. Soc. Lond. **22,** 226, (1859), Ellis, J. B. & B. M. Everhart North Amer. Pyren. 639, (1892), Povah, A. Phytopathology **14,** 140—145, (1924), Schreiner, E. J. Mycologia **17,** 218—220, (1925).

Stromata superficial or erumpent from bark as in *H. ravenelii*, aplanopulvinate or aplanate, 1·5—7×1·8—00×1·8—7 mm. Ectostroma white, at first continuous, late becoming granulate and persisting feebly at maturity or merging with the entostroma and turning dull grey black. Carbonous layer of entostroma massive, deep black, basal tissue well developed, corky, dull white to dull brown. Perithecia rarely solitary, usually between 5 and an indefinite number per stroma, vertices evident or only vaguely so, usually appearing polygonal and somewhat straight-sided in horizontal outline, 800—1300×700—1200μ; ostioles papillate, ranging from very small to highly prominent. Spores elliptic to nearly cylindric, equilateral, medium to dark brown, 5·0—14·0×15·0—31·5μ ave. 9·3×23·2μ.

Material examined:

A large quantity of material in the Helsinki and Ann Arbor Herbaria. Davidson; on *Populus tremuloides*, N.B. Canada, (FBLNB). Davidson in FPF 395; on *Alnus* sp., Southbrooke, Nfld., Canada, (FBLNB). FBLA C281 (= Martin 620); Stanley, on *Populus tremuloides*, Shaftesbury, Alberta, Canada, (1961), (FBLA). FBLBC 847, 850, (= Martin 619a): on *Quercus* *rubra*, Petawawa Forest Experimental Station, Ontario, Canada, (1961), (FBLBC). FBLBC 9307; on *Populus tremuloides*, Revelstoke, B.C., Canada, (FBLBC). FPF 366; on *Salix* sp., Pasadena, Northfield, Nfld., Canada, (FBLNB). FPF 2961; on *Salix* sp., Rossfield Crossing, Picton, N.S., Canada, (FBLNB). Martin 1700; Mt. Toby, Mass., U.S.A., (1963). Martin 1722; Savoy State Forest, Mass., U.S.A., (1963).

Cultural Characteristics:

Germination pattern free spreading. Colonies felty, growing free with a fine texture, uniform, purple brown with a grey surface eventually due to the production of conidia. Margin not distinct, entire, with the peripheral hyphae lying close together. Stain dull buff brown; carbonization absent. Growth at 25°C very slow, 1·00 mm./day.

Microscopic Characters:

Primary mycelium undiagnostic; maximum diameter of the marginal hyphae $= 2\cdot 3\mu$. Secondary mycelium closely anastomosed, uniform, $1\cdot 8$—$4\cdot 3\mu$ diam.

Imperfect Stage (Fig. III: 8):

sub *Hypoxylon holwayi* Ellis. Ellis, J. B. Amer. Nat. **17,** 193, (1883), Gruenhagen, R. H. Phytopathology **35,** 72—89, (1945), Ponomareff, N. V. Phytopathology **28**, 515—518, (1938).

Conidiophores not clearly distinct from the vegetative mycelium, 210—$540\times 1\cdot 8\mu$, dichotomously or ternately branched indefinitely over the upper segments of the primary axes which are normally very broad in diameter. Fertile branches 11—$25\times 1\cdot 5$—$1\cdot 8\mu$ lying freely, geniculate. Conidia in short spicate pleuracrogenous or acrogenous clusters, sessile, elliptic to clavate with narrow truncate bases, white en masse, $1\cdot 2$—$3\cdot 0\times 5\cdot 6$—$8\cdot 4\mu$ ave. $2\cdot 8\times 7\cdot 4\mu$.

Discussion and Conclusion:

The reasons for the separation and establishment of the section Entoleuca from the other groups of the genus *Hypoxylon* were discussed in a previous paper (Martin, 1967b). The writer believes that the former exclusion of many species from *Hypoxylon* on the grounds of perithecial number is an arbitrary distinction. The question that arises is whether by merging them we have created a natural group. The resolution of this problem is always likely to be subjective, but it is interesting upon analysis to find that there are in fact several conflicting patterns of organization among the species. These are best expressed in the following table.

In Group I belong all the large spored, dark subiculate members of the former genus *Rosellinia*. Many of these produce *Graphium* type coremia. Species

CHARACTER							SPECIES GROUP
Basal tissue slightly developed, white or dull coloured (Fig. I : 2)	Ascal plugs constricted, spores large elongate elliptic; ± subiculum of dark hyphae and ascospore appendages; colonies usually rapidly growing, germ slit usually on convex side of ascospore	Colonies silky or felty, uniform, ± mottled carbonization; *Graphium* type coremia often present. Conidiophores normally stout	Germination pattern free spreading	Stromata 1—few peritheciate		*H. aquilum* *H. aridicolum* *H. corticium* *H. thelenum*	IA
				Stromata 1—α peritheciate		*H. diathrauston*	IB
	Ascal plugs straight rectangular or cubic, spores normally of small or moderate size, if 17 u long then not elongate elliptic; subiculum of dark hyphae lacking, ascospore appendages lacking; colonies growing at a slow or moderate rate, germ slit on concave side of ascospore.	Colonies canescent, uniform, rough granulate with age.	Germination —pattern— radiate	Stromata —1—few— peritheciate		*H. perusensis* *H. ravenelii*	IIA
						H. glandiformis *H. ludovicianum*	IIB
		Colonies canescent, normally uniform with rapid and profuse conidial formation, no coremia, conidiophores slender	Germination pattern free spreading	Stromata 1—α peritheciate		*H. cuneosporum* *H. regale* *H. serpens*	IIC
			Germination pattern radiate	Stromata 1—few peritheciate		*H. chrysoconium* *H. mastoideum* *H. minutissimum*	IIIA
		Colonies velvety or felty, often zonate, conidial production delayed; no coremia; conidiophores slender			Nodulisporium type I	*H. albocinctum* *H. pynaerthii*	IIIB
						H. adumbratio *H. illitum* *H. smilacicolum*	
Basal tissue well developed, dull coloured			Germination pattern free spreading	Stromata few—α peritheciate		*H. mammatum*	IIIC
Basal tissue well developed, conspicuous white or bright coloured Fig. I : 1)						*H. sassafras* *H. cadigensis*	IV
					Nodulisporium type I	*H. discolor* *H. entoleucum*	

not considered here that should probably be included comprise *H. acuminosporum*, *H. asperatum*, *H. bunodes*, *H. buxi*, *H. gigasporum*, *H. pulcherrimum*, *H. radiciperdum* and *H. rostrisporum*.

In Group II and III belong the bulk of the members of *Rosellinia* and *Hypoxylon* with small to medium sized black stromata that produce canescent to velvety colonies in culture. Species that ought probably to be included here comprise *H. albolanatum*, *H. apiculatum*, *H. bicoloratum*, *H. callimorphum*, *H. confluens*, *H. culmorum*, *H. folicola*, *H. geasteroides*, *H. grandineum*, *H. griseocinctum*, *H. herpotrichiodes*, *H. julii*, *H. langloisii*, *H. mammiformis*, *H. medullaris*, *H. megalocarpum*, *H. megalosporum*, *H. morgani*, *H. mutans*, *H. mummularioides*, *H. poliosum*, *H. protuberans*, *H. quadratum*, *H. rosellinioides*, *H. sphaeriostomum*, *H. subacutum*, *H. subaenum*, *H. sublimbatum*, *H. tassianum* and *H. victoriae*.

In Group IV belong many members of the former genus *Penzigia*, together with others in *Hypoxylon* that are similar in having a well developed white or brightly coloured basal tissue. Species that should probably be included here comprise *H. bermudensis* and *H. citrinum*.

When further information is available, it should be possible to say whether this classification is sufficient or whether it should be improved upon.

Latin Diagnoses of New Species.

2. *Hypoxylon aridicolum* Martin nov. sp.

Stromata globosa aut pulvinata, cum uno aut duo perithecia, gregaria in subiculo fusco in ligno mortuo. Perithecia magna globosa, 1500—200 × 1200—1700μ. Asci non visi. Sporae ellipticae, acutae, inaequis lateribus, pallidae fuscae, 4·5—9·0 × 14·0—24·0, medius 6·8 × 18·7μ.

6. *Hypoxylon cuneosporum* nov. sp.

Stromata aplanopulvinata, globosa, 5—20 mm. lata, in exteriore ligno; nigra obscura; entostroma interiora conspicua alba. Perithecia globosa, 300—400 × 500—600μ, ostiola papillata; asci cylindrici, cum ferme longis stipitis 90—150 × 6μ; stipes 35—75 × μ Spores ovalae, ferme inaequis lateribus cum uno termino conico, pallidae fuscae, 3·5—7·0 × 9·5—14·5μ, medius 5·0 × 11·7μ.

12. *Hypoxylon entoleucum* Martin nov. sp.

Stromata aplanata, crustata, praecipue mollis 0·6 mm. altitudo cum superficie carbonaceo. Perithecia prominentes, aggregata sed non coalescentes. Entostroma interiora conspicua alba et magna aucta. Perithecia globosa, 400—650 × 400—500μ, ostiola obscura papillata. Asci non visi. Sporae ellipticae, navicularae, pallidae fuscae, 5·0—8·5 × 14·0—19·0μ medius 6·4 × 16·4μ.

13. *Hypoxylon minutissimum* Martin nov. sp.

Stromata minuta, globosa, nigra obscura, cum perithecio singulo, sed gregaria in ligno decorticato. Perithecia 200—300 × 1500—250μ; ostiola papillata confusa. Asci clavati, breve stipitati, 75·90 × 8μ, stipes 18—21 × 3μ. Sporae ovalae subglobosae, pallidae fuscae, 5·0—8·0 × 6·0—10·5μ, medius 6·2 × 8·5μ.

17. *Hypoxylon adumbratio* Martin nov. sp.

Stromata ferme cum crebris peritheciis, aplanata-effusa, sed aliquando pulvinata cum singulo aut paucis peritheciis, nigra nitensque. Perithecia magna 750—1200 × 700—2000μ. Ostiola papillata ferme fastigata, saepe circumplecta ab iugis superficialis. Asci cylindrici, cum longis stipitis, 180—250 × 6μ; stipes 100—170μ. Sporae ovalae inaequis lateribus, navicularae, obscurae fuscae, 3·5—7·0 × 11·0—16·0μ, medius 5·3 × 13·1μ.

23. *Hypoxylon ludovicianum* Martin nov. sp.

Stromata pulvinata aut aplanapulvinata, nigra obscura, cum perithecio singulo aut multis peritheciis. Perithecia hemisphaerica, 400—1100 × 400—900μ; ostiola papillata vel minuta. Asci non visi. Sporae ovalae, ellipticae, inaequis lateribus, pallidae fuscae, 4·5—7·0 × 10·0—16·5μ, medius 5·8 × 12·3μ.

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